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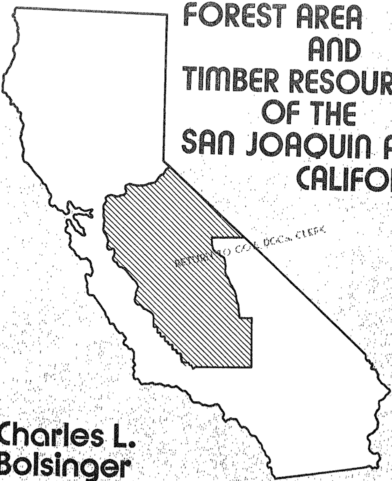
# FOREST AREA AND TIMBER RESOURCES OF THE SAN JOAQUIN AREA CALIFORNIA



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## Charles L. Bolsinger

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
PORTLAND, OREGON

## RENEWABLE RESOURCES EVALUATION WORK UNIT

Charles Van Sickle, Project Leader
Donald R. Gedney, Principal Resource Analyst
John M. Berger, Compilation Supervisor
Charles L. Bolsinger, Field Supervisor

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Regions 4 and 5 of the U.S. Forest Service supplied resource data and other information for National Forests. The California Department of Forestry, and the Bureau of Land Management and the Bureau of Indian Affairs, U.S. Department of the Interior, provided information on the management of lands under their jurisdiction. Private landowners provided maps and information on access to forest lands, and information related to forest management practices.

## METRIC EQUIVALENTS

1,000 acres = 404.69 hectares
1,000 cubic feet = 28.3 cubic meters
1 cubic foot per acre = 0.0700 cubic meter per hectare
1 square foot basal area per acre = 0.2296 square meter per hectare
1 foot = 30.48 centimeters
1 inch = 2.540 centimeters

# FOREST AREA AND TIMBER RESOURCES OF THE SAN JOAQUIN RESOURCE AREA, CALIFORNIA

## Reference Abstract

Bolsinger, Charles L.
1978. Forest area and timber resources of the San Joaquin resource area, California. USDA For. Serv. Resour. Bull. PNW-75, 71 p., illus. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

This report presents statistics on forest area and timber volume and a description of the recent and future timber situations in Alpine, Amador, Calaveras, Fresno, Kern, Kings, Madera, Mariposa, Merced, Mono, San Joaquin, Stanislaus, Tulare, and Tuolumne Counties, California.

KEYWORDS: Forest surveys, statistics (forest), timber resources, resources (forest), California (central).

## RESEARCH SUMMARY

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### 1978

The San Joaquin resource area, consisting of 14 counties in central California, contains over 7 million acres of forest land--of which 2.2 million acres are classified as commercial forest. Productive forest reserved in parks and wilderness amounts to about 0.7 million acres and unproductive forest, largely foothill oak and chaparral, amounts to about 4.0 million acres. National Forests contain 77 percent of the commercial forest land. National Parks contain 91 percent of the productive reserved forest land. Unproductive forest land is divided almost equally between private owners and public agencies.

Between 1953 and 1973 about 31,000 acres of commercial forest, mostly in private ownership, were converted to pasture, residential developments, reservoirs, and other permanent clearings; 18,000 acres of commercial forest were set aside in National Forest Wilderness and another 17,000 acres were set aside to be studied for possible Wilderness designation. About 117,000 acres of private forest land were reclassified from commercial to unproductive by current methods of determining forest stockability and site potential.

Most of the reclassified area was in the lower western foothills of the Sierra Nevada and in the forest-desert fringe in Alpine and Mono Counties.

Unproductive forest area was reduced by about 265,000 acres between 1953 and 1973, largely by conversion to rangeland and development of water resources.

Potential productivity of the commercial forest land is extremely variable, ranging from sites capable of growing more than 165 cubic feet of wood per acre per year to sites that can barely grow 20. About 41 percent of the commercial forest land can grow at least 85 cubic feet, including 37 percent of National Forests, 39 percent of other public lands, 84 percent of forest industry lands, and 42 percent of other private lands.

Commercial forest lands outside National Forests were classified into manageability categories based on steepness, stockability, and site index. Flat to gently sloping timberlands without stockability problems make up 63 percent of the total, including 47 percent in high sites (85 cubic feet plus) and 16 percent in low sites. Timberlands that are steep and/or have stockability problems make up 37 percent.

The stocking condition of commercial forest land is generally good--only 2.7 percent of National Forests and 4.0 percent of lands outside National Forests are nonstocked with desirable conifer trees. None of the forest industry land was nonstocked at the time of the inventory. On private lands, however, high mortality occurs in white fir and a large area is occupied by low-volume, low-value incense-cedar and hardwood trees. The mortality in white fir is seen as temporary and minor, but the incense-cedar-hardwood situation may limit forest productivity for years to come.

Total volume in growing stock and sawtimber is 8.3 billion cubic feet and 47.4 billion board feet (Scribner rule). Over 95 percent of the volume is in softwoods. National Forests contain 86 percent of the softwood and 78 percent of the hardwood sawtimber volume. Since 1953 the softwood inventory has declined about 12 percent on National Forests and 33 percent on private lands. Fires, pests, conversions, and withdrawals have also reduced the available inventory, but by a small amount.

Net annual growth of growing stock totals 72.3 million cubic feet on National Forests or an average of 42 cubic feet per acre per year. Forests outside National Forests are growing 29 million cubic feet per year, an average of 56 cubic feet per acre per year.

Mortality averages 13 cubic feet per acre per year on National Forests and 12 cubic feet on all other lands. Forest industry lands have the highest mortality, mostly in white fir. Weather, insects, disease, and logging damage were the primary causes of mortality at the time of the inventory.

Timber harvest in the area has remained fairly constant at 400 million to 600 million board feet for over 25 years. The cut in recent years is roughly 12 percent of California's total. The timber provides jobs for about 9,000 people in the area's forests and mills. This is about 2 percent of total employment in the 14 counties and 11 percent of manufacturing employment. Forest industries provide a significant portion of total employment in certain mountain communities.

National Forests contributed an increasing proportion of the cut from 1953 to 1972 while cut on private lands decreased. Since 1972, however, National Forest cut has declined somewhat because of shortage of funds and personnel and delays in timber sale administration due to land use planning and litigation. Further decline in the cut may result from Wilderness classification of some or all of the 137,000 acres of productive forest in roadless areas. These areas contain about 3 billion board feet and have an estimated potential yield of 39 million board feet, roughly 8 percent of the total for National Forests in the area.

The long-term productivity of National Forests appears about equal to the current harvest from all components of commercial forest land. More information on land capability, management techniques and response, interactions of resources, and demand for various forest outputs is needed before the ultimate timber productivity can be determined.

Farmer and miscellaneous privately owned lands are producing considerably less than their potential, and their owners are harvesting only a third of their annual growth. Nonforest developments on farmer and miscellaneous private ownerships were underway on 40,000 acres of land still forested when fieldwork was done. The estimated growth loss by these conversions will amount to 9 percent of the total annual growth on all private lands in the San Joaquin resource area.

Forest industry lands have been yielding timber for several decades. Their cut is slightly less than growth, and it appears they could continue to produce timber at the current level indefinitely. Even these lands, however, are producing somewhat less than their potential.

There seems little incentive for private landowners in the San Joaquin area to make forestry investments to increase timber production. Growing pressure to develop land for nontimber purposes suggests, however, that intensified forest management on lands dedicated to timber production is needed to prevent a future timber shortage.

# PREFACE

This report summarizes the results of the 1972 inventory of forest land area and timber resources outside National Forests in 14 counties in California. The counties are Alpine, Amador, Calaveras, Fresno, Kern, Kings, Madera, Mariposa, Merced, Mono, San Joaquin, Stanislaus, Tulare, and Tuolumne. Also included in this report are estimates of total area of commercial and productive reserved forest land and timber volume for National Forest lands in the 14 counties. Current forest resource details comparable to those for other lands are not available for all National Forest lands within the area.

Previous Forest Service reports on California's timber resources have been published, but only one contained specific information for the counties in the San Joaquin resource area--USDA Forest Survey Release No. 25, "Forest Statistics for California" (USDA Forest Service 1954). County details in Release No. 25 included only commercial forest area by public and private ownership and total noncommercial forest area.

The objectives of the 1972 inventory were to estimate the total area of forest land and timber volume, growth, and mortality, by ownership and to determine other facts about forests for the use of planners, policymakers, resource managers and users, and others interested in natural resources.

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# THE SETTING

The San Joaquin resource area, with a total land area of 23.3 million acres, is comprised of three distinct geographic provinces: (1) the southern part of California's Great Central Valley, one of the richest agricultural regions in the world and containing the leading county (Fresno) in the Nation in gross value of agriculture (State of California, Documents Section 1975); (2) the dry eastern slopes of the Coast Ranges, an area of vast grasslands and brushfields; and (3) the Sierra Nevada and Tehachapi Mountains, rich in natural wonders such as Yosemite Valley and the giant sequoias[1] (fig. 1).

*Figure 1.--A giant sequoia tree in the Sierra National Forest. This unique species is found in scattered groves in the higher elevations of the mixed conifer forests and lower elevations of the white fir-red fir forests.*

Numerous cities cluster along the main highways in the Central Valley. Among the larger cities are Stockton, Fresno, Bakersfield, Merced, Lodi, Modesto, and Visalia. Smaller towns dot the western foothills of the Sierra Nevada and include history-rich places such as Sutter Creek, Angels Camp, Sonora, Columbia, and Coulterville.

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[1] Scientific names of plants are listed under "Plant Species."

The population in 1975 in the 14 counties was 1.8 million persons, a 24-percent increase since 1960. The population increase for the entire State during this period was 33 percent.

Natural vegetation is extremely variable, reflecting the diversity in topography, climate, and soils (fig. 2). Mono County, east of the Sierra Nevada, and Kern County at the southern end of the region have more than 1-1/2 million acres of desert,[2] occupied by creosote bush, saltbush, greasewood, and other desert shrubs. Inland sagebrush-steppe amounts to three-quarter-million acres, mostly upslope from the desert in Alpine and Mono Counties. Coastal sagebrush covers more than one-half-million acres of the hills west of the Great Central Valley. Grassland, amounting to about 3-1/2 million acres, makes up the bulk of the lower foothill country, occurs as high mountain meadows (fig. 3), and is still found in some parts of the Valley. Much of the native grassland vegetation has been replaced by introduced species, including many annuals.

Forest, woodland, and chaparral extend over 7 million acres of the higher foothills and mountains. Included are brushfields and hardwood forests in the foothills west of the Sierra Nevada, juniper-pinyon pine in the upper reaches of the sagebrush-steppe, and the timber-producing coniferous forests from the upper foothills to the higher mountains.

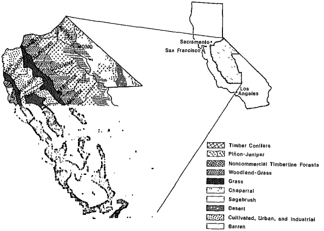

*Figure 2.--Vegetation types of the San Joaquin resource area.*

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[2] The source for area information on nonforest types is the California Fish and Wildlife Plan (California Department of Fish and Game 1966).

*Figure 3.--Mountain meadows and forest land east of the Sierra Crest in the Toiyabe National Forest. Such areas, though containing timber, are more important for summer livestock range, wildlife habitat, and recreational use.*

Three major forest associations are within the coniferous forest zone: (1) Ponderosa and/or Jeffrey pine. Jeffrey pine occurs mostly east of the Sierra Nevada crest; ponderosa pine mostly on the western slopes in the midelevations to lower elevations. (2) Mixed conifer occurs in the midelevations and consists of various combinations of white fir, sugar pine, ponderosa pine, incense-cedar, and Douglas-fir (rare to absent in the south). (3) White fir and/or California red fir occurs in the higher elevations. Red fir stands often include mountain hemlock and western white pine in the higher elevations, and burned areas often restock to lodgepole pine. California black oak occurs in the lower part of the mixed conifer zone and also appears as scattered trees or in pockets among stands of ponderosa pine in the southern Sierra Nevada. At the upper reaches of the coniferous zone are the timberline forests of stunted, noncommercial trees.

Above the coniferous forests and mountain meadows are the barren, rocky peaks of the High Sierra, accounting for over 800,000 acres in the San Joaquin area.

Riparian vegetation in narrow stringers along streams in the lower canyons and the Valley occupies about 50,000 acres. This type is extremely important for wildlife. It is decreasing rapidly mainly because of agricultural development. The marsh vegetation type is important habitat for waterfowl, water birds, shore birds, and fur bearers, and is decreasing. Marshes cover about 130,000 acres, a fraction of their original area.

# THE IMPORTANCE OF FORESTS IN THE SAN JOAQUIN RESOURCE AREA

Forests in the San Joaquin area contain a wealth of resources. Some resources--wildlife, water, and forage for example--are better labeled "forest-related" resources since they often cannot be singled out as products of forests alone. A brief sketch of the forest-related resource situation in the San Joaquin resource area follows.

1. *Outdoor recreation.*--The many outstanding scenic attractions and the vast area of land accessible to the public draw people from all over the United States and the world, as well as from the San Francisco and Los Angeles areas. In 1970 outdoor recreation activities accounted for 376 million participation days. By 1990 recreation use is projected to 640 million participation days--a 70-percent increase.[3]

2. *Water.*--Much of the water used in California originates as rain and snow on forest lands. The San Joaquin area is an important source of water. The total volume of developed water used in California in 1972 was 30.7 million acre-feet, of which the San Joaquin and Tulare Basins (these basins comprise most of the area covered in this report) supplied 11.0 million acre-feet. By 2020, the San Joaquin and Tulare Basins are projected to supply 12.2 million acre-feet, but this is 1.1 million to 6.3 million acre-feet short of projected demands from this region (California Department of Water Resources 1974).

3. *Wildlife.*--The area is rich in both game and nongame species. For example, there are an estimated 60,000 mule deer on four of the seven National Forests, and 17,000 bucks were bagged by hunters from 1969 through 1973. Hunter-days for all game amount to about 3 million or 30 percent of the State's total. About 40 percent of California's cold water fishing streams and 30 percent of its warm water fishing streams flow through the area.[4]

4. *Grazing.*--Livestock grazing is the predominant commodity use of the vast area of privately owned unproductive forest land. Grazing is also important on government lands, especially in the summer. In the San Joaquin area, exclusive of Mono County, about 8.4 million acres are grazed by 1.5 million cattle and 0.5 million sheep, about 35 percent of the State's total (see footnote 4).

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[3] Source: State of California, Department of Parks and Recreation.

[4] U.S. Department of Agriculture, Forest Service. 1974. San Joaquin planning area guide. (Draft.) Reg. Off., San Francisco.

5. *Timber.*--From 1945 to 1975 about 15 billion board feet of timber were cut in the 14-county area (California Division of Forestry 1947-75). The recent timber harvest of 500 million to 600 million board feet is about 12 percent of the State's total timber harvest. Manufacturing of wood products from this timber provides jobs for about 9,000 people in the area.[5]

# FOREST AREA AND OWNERSHIP

## CURRENT FOREST AREA

About 7 million acres or 30 percent of the total land area in the 14 counties has been classified as forest land, 63 percent as nonforest-land, and 7 percent has not been classified. The following tabulation shows total acreage by land class and owner:

| Land Class and Owner[6] | Acres | Percent of area |
|---|---|---|
| Commercial forest in National Forests | 1,733,000 | 7.4 |
| Commercial forest outside National Forests | 512,000 | 2.2 |
| Total commercial forest land | 2,245,000 | 9.6 |
| Productive reserved forest in National Forests | 39,000 | .2 |
| Productive deferred forest in National Forests | 17,000 | .1 |
| Productive reserved forest outside National Forests | 615,000 | 2.6 |
| Total productive reserved and productive deferred lands | 671,000 | 2.9 |
| Unproductive forest in National Forests | 1,101,000 | 4.7 |
| Unproductive forest in Parks outside National Forests | 513,000 | 2.2 |
| Unproductive forest outside National Forests and Parks | 2,424,000 | 10.4 |
| Total land classified as unproductive forest | 4,038,000 | 17.3 |
| Unproductive forest and nonforest land in National Forests (unclassified)[7] | 1,586,000 | 6.8 |
| Classified nonforest lands in National Forests | 627,000 | 2.7 |
| Nonforest land outside National Forests | 14,149,000 | 60.7 |
| Total land area | 23,316,000 | 100.0 |

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[5] Source: State of California, Employment Development Department.
[6] See "Definition of Terms," page 53.
[7] Much of this is wilderness.

## PRODUCTIVE RESERVED AND DEFERRED FOREST LAND

*Productive reserved forests* are capable of growing at least 20 cubic feet of wood per acre per year, and are set aside in parks or Wilderness or other reservations. Within these reservations are some of the Nation's most spectacular scenery and most visited recreation spots, including Sequoia, Kings Canyon, and Yosemite National Parks, Devils' Postpile National Monument; John Muir, Minarets, and Domelands Wildernesses; High Sierra Primitive Area; and Calaveras Big Trees State Park.

Timber cutting for commodity production is prohibited in these reservations which, however, are used for various purposes. They are important as watershed and wildlife habitat, as well as for recreation. Hunting is not allowed in national parks, but many game animals that spend part of the year on park lands migrate to areas where they may be hunted (California Department of Fish and Game 1966). Many nongame species in the parks are viewed by thousands of visitors annually.

The timber productivity of these areas has not been estimated. The parks and Wilderness contain some very productive timberland, such as that in and near the giant sequoia groves. Extensive areas, generally at high elevations, with short-growing seasons and daily and annual temperature extremes, are poor timber sites. They are steep and rocky, and the soils are shallow. Such areas outside reservations have not been managed successfully for sustained timber production. The long-term value forgone in timber within these reservations is comparatively low.

*Deferred forest* lands are productive forest areas *in National Forests* that are being studied for possible Wilderness classification.

Of the 671,000 acres of productive reserved and deferred forest land, 609,000 acres or 91 percent are in Kings Canyon, Sequoia, and Yosemite National Parks (fig. 4).

### Changes in Productive Reserved Forest

Between 1953 and 1973, productive reserved areas have increased 19,000 acres--18,000 acres in National Forest wilderness and about 1,000 acres in State and county parks. The total acreage in Wilderness and parks has increased by a much greater amount, but much of the area is not productive forest.

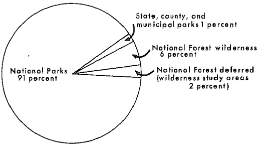

*Figure 4.--Most of the productive reserved forest is in National Parks.*

UNPRODUCTIVE FOREST LAND[8]

Of the 4,038,000 acres classified as unproductive forest land, 47 percent is held by farmers and miscellaneous private owners and 53 percent by public agencies (fig. 5).

Ownership of the unproductive forest land is significant from the standpoint of total resource planning and use. Unproductive forest cover on U.S. Forest Service and Bureau of Land Management (BLM) lands may be manipulated or removed for various resource management purposes. Conversely, the policy is that forest cover in National Parks and Wilderness must not be disturbed.

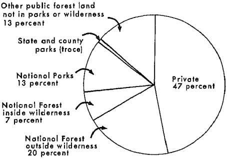

*Figure 5.--Unproductive forest land is divided almost equally between private and public owners.*

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[8] Does not include unproductive forest in the 1,586,000 acres of unclassified National Forest land.

Subdivision and development for recreational and residential use of privately owned unproductive forest is increasing, especially in the oak and highly flammable chaparral types. One result is a reduction in the State-administered controlled burning of brushland to increase livestock grazing or improve wildlife habitat. This is caused in part by fear of liability for property damages, suppression costs in case a fire escapes and restrictions related to air pollution control (California Division of Forestry 1961-74). The reduction of controlled burning is thought to be related to the *increase* in the average annual acreage burned by wildfire caused by fuel buildup.

## Unproductive Forest Types and Categories

*Oak* stands cover 1,838,000 acres or 46 percent of the unproductive forest land (fig. 6). They grow in the western foothills of the Sierra Nevada (fig. 7) and eastern slopes of the Coast Ranges. Blue oak, interior live oak, and canyon live oak are the most prevalent species, but California white oak and occasionally California black oak also occur in the unproductive oak type. Other tree species, such as Digger pine, California buckeye, California laurel, and mountainmahogany, and brush species are often present.

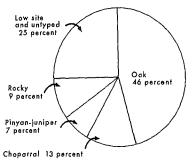

*Figure 6.--Nearly half the unproductive forest land is occupied by oak.*

Except for fuelwood and posts, little industrial use is made of the oak forests. Much of this type is grazed by livestock and clearing to increase forage production is steadily reducing its area. Oak forests are important wildlife habitat, especially where they grade into chaparral. The highest year-round deer populations may be found in this type (California Department of Fish and Game 1966).

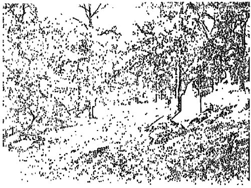

*Figure 7.--Blue oak forest on private land in the western foothills of the Sierra Nevada. The area to the left of the fence has been heavily grazed.*

*Chaparrel* occupies 512,000 acres or 13 percent of the unproductive forest land in the lower foothills of the Sierra Nevada and at all elevations in the Coast Ranges. This type consists of tall brush or dwarf trees such as manzanitas, ceanothus, scrub or shin oak, chamise, California redbud, and toyon. Chaparral is typically dense, which limits the use of the land for grazing. For this reason, large areas of chaparral, as well as oak, have been cleared by burning and/or mechanical treatment. Burned areas often resprout and revert to chaparral. Wildlife populations are often high in chaparral, especially near type boundaries. Quail, rabbits, grey fox, and many other animals inhabit this type. In resprouting stands, deer browse is temporarily excellent (California Department of Fish and Game 1966).

The *pinyon-juniper* type occupies 292,000 acres or 7 percent of the unproductive forest in the dry eastern reaches of Tulare County, in eastern and southern Kern County, and east of the Sierra Nevada crest in Alpine and Mono Counties. This type is commonly associated with sagebrush, bitterbrush, and rabbit-brush on land that has potential grazing value which can be realized by clearing and seeding to grass. The pinyon-juniper type is important to many wildlife species, including quail, chukars, rabbits, band-tailed pigeons, and furbearers. It is especially important as deer winter range.

*Rocky*, unproductive forest lands total 368,000 acres or 9 percent of the unproductive forest. They are capable of growing 20 cubic feet or more of industrial wood per acre per year but are too steep or rocky for timber production. Examples are steep, timbered slopes along major rivers such as the Stanislaus, Mokelumne (fig. 8), and Kings Rivers, and boulder-strewn forests east of Huntington Lake. Much of the rocky, unproductive forest lands are in the National Parks.

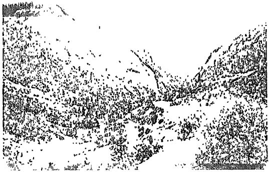

*Figure 8.--Mokelumne River Canyon. Slopes along most of the major rivers in the Sierra Nevada are often too steep and rocky to manage for continuous timber production.*

Land that can support commercial trees but not of sufficient size or in sufficient numbers to qualify as commercial forest is classified as "low site" unproductive forest. Such areas total 48,000 acres outside National Forests. There are 980,000 acres of unproductive forest land not specified by type within National Forests. The low site and untyped, unproductive forest lands total 1,028,000 acres or 25 percent of the unproductive forest area.

## Changes in Unproductive Forest

The 1973 estimate of unproductive forest land is considerably lower than the USDA Forest Service's (1954) estimate in 1953.[9] Most of the reduction is due to clearing of oak and chaparral on private lands. From 1953 to 1972 about 340,000 acres were cleared by burning with or without mechanical or chemical treatment. About 50 percent were reburned to control sprouting, which resulted in a net acreage cleared of about 170,000 acres. About 25 percent of these areas were seeded to grass or clover (California Division of Forestry 1961-74). Wildfires burned about 130,000 acres of oak and chaparral during this same period (California Division of Forestry 1953-74). About 50 percent of these burned areas are assumed to have reverted to oak or chaparral, which leaves 65,000 acres of nonforest. The sum of the area cleared by controlled burning and wildfire is 235,000 acres.

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[9] The 1953 estimates were based on work done by Wieslander and Jensen (1946).

Between 1953 and 1972, over 40 reservoirs were built, inundating about 68,000 acres,[10] mostly in the foothills of the Sierra Nevada (California Department of Water Resources 1972). These reservoirs replaced about 30,000 acres of oak and chaparral.

Urban development, road and powerline construction, and other factors also reduced the area of unproductive forest land, by an unknown amount.

COMMERCIAL FOREST LAND

Commercial forest land, as defined by the U.S. Forest Service, is capable of producing at least 20 cubic feet of industrial wood and has not been developed for nonforest use.

Of the total commercial forest land, 1,733,000 acres or 77 percent is in National Forests (fig. 9). Other public ownerships total 43,000 acres or 2 percent. They consist mainly of Mountain Home State Forest and Tule River Indian Reservation[11] in Tulare County and of scattered tracts of land administered by the Bureau of Land Management.

Commercial forest in private ownership totals 469,000 acres or 21 percent.

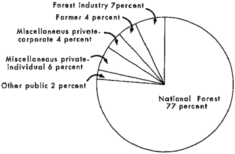

*Figure 9.--Over three-quarters of the commercial forest land is in National Forests.*

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[10] New Melones Reservoir in Tuolumne and Calaveras Counties was not completed when this forest inventory was made, but its area--12,500 acres--is included.

[11] Indian lands are privately owned and are managed under the guidance of the Bureau of Indian Affairs. They are classified as public in this study in conformance with standard nationwide ownership definitions.

## Changes in Commercial Forest Area, 1953-73

The following changes in commercial forest land occurred between 1953 and 1973:

*National Forests*[12]

| Cause of change | Acres |
|---|---|
| Powerlines, reservoirs, roads | -6,900 |
| Land exchanges | +2,000 |
| Designated as Wilderness | -18,000 |
| Deferred status (wilderness study areas) | -17,000 |
| Net total | -39,900 |

*Other Public and Private Lands*

| Cause of change | Acres |
|---|---|
| Physical changes to nonforest | -24,000 |
| Land acquired by National Forests | -2,000 |
| Reclassification to noncommercial forest | |
| 1. Stockability factors | -21,000 |
| 2. West-side Sierra Nevada transition zone | -96,000 |
| Undetermined causes | -58,000 |
| Total change | -201,000 |

For other public and private lands, physical changes included clearing for grazing, residential-recreational developments, reservoirs, roads, and powerlines.[13]

Grazing developments were scattered along the western foothills of the Sierra Nevada, generally on low quality timberland. Residential-recreational developments were mostly on high quality timberland and were concentrated in a few scenic and easily accessible localities, such as the White Pine-Arnold area in Calaveras County and the Miwuk Village area in Tuolumne County. Changes caused by stockability factors were based on a method of estimating productivity in areas where tree stocking is limited by environmental factors (MacLean and Bolsinger 1973b, 1974).

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[12] Source: U.S. Forest Service, Regional Offices for Regions 4 and 5.

[13] Determined from public records and by examination of 1972 plot locations on the 1953 timber stand maps (California Division of Forestry 1969) and aerial photographs.

Transition zone forests in the front country on the west slope of the Sierra Nevada consist of a mosaic of conifer stands, oak, chaparral, bare rocky hills, and steep canyons. Sample locations within this broad zone were spotted on the 1953 timber stand maps and were visited on the ground. Several plots typed as commercial timberland in 1953 were classified as unproductive forest in 1972. Of these plots representing a 96,000-acre reduction in commercial forest, 45 percent were in extensive areas completely devoid of conifers or of indications that conifers had ever grown there. Interior live oak, canyon live oak, blue oak, and Digger pine were the common tree species. An additional 27 percent were type "island" over an acre in size that contained no signs of commercial conifers but were within general areas supporting some commercial conifers. Eighteen percent supported scattered commercial conifers, usually short and poorly formed, growing in soil pockets among rocks, along drainages, or other microsites not large enough to qualify as commercial forest. Ten percent had obviously supported commercial conifers in the past but had been heavily disturbed; loss of the topsoil and changes in vegetation were judged permanent.

The front country of the Sierra Nevada has experienced a century and a quarter of mining, logging, burning, and grazing. Severe and repeated disturbance has caused extensive soil movement, altered the water table, and pushed back the commercial forest an average of 10 miles over much of the Mother Lode country.[14/] The prolonged dry cycle in the southern Sierra Nevada also is judged a contributing factor in the retreating forest type.[15/]

Records exist of ponderosa pine stands in areas that now support only oak, chaparral, and Digger pine. Local landowners cite examples of forest type changes within their lifetimes. Some of these areas may still be capable of supporting commercial conifers but only after expensive treatment. The oak and brush would have to be removed or thinned, a continuous problem because of their sprouting characteristics. Some shade would be needed to protect conifer seedlings, which would complicate matters. Rodents and other animals would have to be controlled. This is unlikely to happen. The general practice has been to convert these marginal types to range rather than timber. Estimates of timber volume were not affected, since these types generally contain no growing-stock trees.

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[14/] Personal communication on August 6, 1976, with Wilmer Colwell, Director of the California Soils-Vegetation Survey project.

[15/] California Fish and Wildlife Plan, California Department of Fish and Game (1966), Vol. III, appendix--provisional projections of California areas and counties to 1980.

## Timber Management Characteristics of the Ownerships

### *National Forest*

National Forests are managed for continuous production of various commodities and amenities including outdoor recreation opportunities, water, fish and wildlife, timber, and forage for livestock. Timber management is planned within a framework of all recognized resource values. Timber is sold on the stump to purchasers who are required to remove trees according to a detailed contract. Through the contract, provisions are made to protect nontimber resource values, maintain timber yield, and minimize waste.

In the development of National Forest timber management plans (USDA Forest Service 1972), the total commercial forest area has been classified into four components of timber management intensity:

1. *Standard component* is regulated commercial forest land on which crops of industrial wood can be grown and harvested with adequate protection of forest resources under the provisions of the timber sale contract.

2. *Special component* is regulated commercial forest for which multiple use plans require specially designed treatment to achieve other resource objectives. Also included are areas where timber management activities are delayed pending multiple use planning and management decisions, travel and water influence zones, peripheral portions of developed sites, classified recreation areas, and areas where timber harvest is a secondary or minor management objective.

3. *Marginal component* is regulated commercial forest land not qualifying as "standard" or "special," primarily because of excessive development cost, low product value, or resource protection constraints. Included may be sites requiring unusual logging techniques (such as helicopters), areas where harvesting is blocked until roads are constructed, or areas with tree species not presently in demand. Also included is the backlog of nonstocked areas that would otherwise be classed as standard but that cannot be reforested without funding.

4. *Unregulated component* is commercial forest land that will not be managed for timber production under sustained yield principles. It includes:

   (a) experimental forests;
   (b) existing and planned recreation development sites, special interest areas, and administrative sites where timber harvest is not a major goal of management, such as ranger stations, guard stations, nurseries, etc.;
   (c) isolated tracts of commercial forest land where sustained periodic harvest is impractical.

The percentages of commercial forest land of National Forests with land in the San Joaquin resource area are:

| Component | Percent |
|---|---|
| Standard | 67.0 |
| Special | 9.4 |
| Marginal | 19.5 |
| Unregulated | 4.1 |

National Forest timber management practices vary, depending on the condition and productivity of the land, funding, and many other factors,[16] including devastating fires, storms, and forest pests. Detailed timber management plans are prepared for each National Forest and revised periodically.

*Other Public Agencies*

The Mountain Home State Forest is managed primarily to preserve and enhance giant sequoias. Under this objective an average annual harvest of 1.5 million board feet of pine, fir, incense-cedar, and hardwoods is allowed.

The Tule River Indian Reservation is managed under the guidance of the Bureau of Indian Affairs to provide income for the Indian owners. Timber is managed on a sustained-yield basis and is periodically cut; the long-term allowable annual harvest is 1 million board feet. The first cycle of cutting was completed in 1972. Currently, the forest is in a growth period with a corresponding low annual cut. From 1973 to 1975 the cut averaged 31,000 board feet.[17]

Lands administered by the Bureau of Land Management are managed for sustained yield under multiple use principles, as defined in the Federal Land Policy and Management Act of 1976 (Public Law 94-579). These lands are scattered parcels managed on a statewide basis. The statewide annual producing capacity of BLM commercial forest lands is estimated to be 51.3 million board feet. The cut is distributed to areas where the most mature timber is available. In 1974 and 1975 the annual cut on BLM land in the San Joaquin resource area averaged 905,000 board feet.[18]

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[16] The recently passed National Forest Management Act of 1976 (Public Law 94-588) redirects the Forest Service in many management activities and also provides for additional funds for specific purposes.

[17] Personal communication with Edward A. Winsor, Area Forester, Bureau of Indian Affairs, Sacramento, California.

[18] Information provided by the BLM State Director's Office, Sacramento, California.

### *Privately Owned Commercial Forests*

Forest industries own some of the highest quality forest lands in the San Joaquin resource area. Intensity of timber management varies from company to company. The long-term timber productivity of these lands is probably dependable. Investment in mills and land is some assurance that the companies will continue to grow timber. Uncertainties of the market and rising land prices may affect the future of timber management more than the present condition of these lands.

At the time this inventory was conducted, five timber companies owned 149,000 acres of commercial forest land in the San Joaquin resource area, as determined from the ownership sample. Over 80 percent of the commercial forest was owned by two large companies. Since the inventory, land belonging to a small company has been purchased by a large company, and some farmer and miscellaneous private forest land has been purchased by a large company. This is part of a continuing trend toward fewer and larger firms.

Most of the 102,000 acres of commercial forest land classed as farmer-owned is at lower elevations where conifer forests grade into oak and chaparral. Owners of the land on which several sample plots fell said they used the land primarily for grazing and considered trees a hindrance.

Miscellaneous private commercial forest land includes 87,000 acres owned by utility companies (such as Southern California Edison and Pacific Gas and Electric), banks and other financial institutions, land and real estate development companies, and churches and other organizations; 131,000 acres are owned by many individuals.

Some of these lands have been managed for timber on a rather extensive basis. Large areas are being subdivided and are changing owners at a rate that seems to preclude all long-term resource uses except for residential-recreational purposes (see "Future Timber Supplies", page 32).

Two recent State laws may change the trends in forestry on private lands: The Z'berg-Warren-Keene-Collier Forest Taxation Reform Act of 1976 (State of California 1976) is designed to encourage landowners to keep land in forestry use and to produce higher yields by discouraging premature cutting. The Z'berg Nejedly Forest Practices Act of 1973 (State of California 1974) is aimed at insuring that the productivity of private forest lands is maintained.

# TIMBER-PRODUCING CONDITION OF THE COMMERCIAL FOREST LAND

## FOREST LAND PRODUCTIVITY

Forests in the San Joaquin resource area are extremely variable in potential for production. There are sites in the arid transition zones on the eastern and western slopes of the Sierra Nevada and in the granitic high country that can produce only 20 to 50 cubic feet of wood annually. MacLean and Bolsinger (1974) showed that extensive areas in these zones are incapable of supporting 60 percent of normal tree stocking. Sample plot data indicate that trees in these difficult areas often are short and poorly formed.

Extensive areas of high quality timberland lie between the oak and chaparral on the lower western slopes of the Sierra Nevada and the granitic high country. Some of these better sites can produce over 165 cubic feet of wood annually.

Most of the poor sites in the lower foothills are in farmer and miscellaneous private ownership. Most of the poor sites in the high granitic country are in National Forests or National Parks. The National Forests also contain a sizable portion of the high quality timberland at the midelevations, though forest industry lands have the highest average timber growing capacity (see table 1, fig. 10). The best timber growing sites in private ownership tend to be concentrated in Amador, Calaveras, and Tuolumne Counties in the northern part of the resource area.

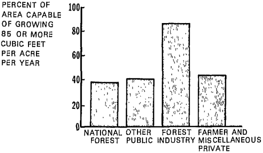

*Figure 10.--Relative productivity of commercial forest land by ownership, San Joaquin resource area.*

Table 1--*Area of commercial forest land by cubic-foot site class and ownership, San Joaquin resource area, California, January 1, 1973*

| Ownership | Cubic-foot site class | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20-49 | | 50-84 | | 85-119 | | 120-164 | | 165+ | | Total | |
| | Thousand acres | Percent | Thousand acres | Percent | Thousand acres | Percent | Thousand acres | Percent | Thousand acres | Percent | Thousand acres | Percent |
| National Forest:[1] | | | | | | | | | | | | |
| Eldorado | 1 | 3 | 5 | 16 | 9 | 29 | 13 | 42 | 3 | 10 | 31 | 100 |
| Inyo[2] | 11 | 13 | 46 | 51 | 21 | 23 | 8 | 9 | 4 | 4 | 90 | 100 |
| Los Padres[2] | 80 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 100 |
| Sequoia | 165 | 37 | 153 | 34 | 74 | 16 | 34 | 7 | 30 | 6 | 456 | 100 |
| Sierra | 67 | 13 | 224 | 42 | 132 | 25 | 56 | 10 | 55 | 10 | 534 | 100 |
| Stanislaus | 52 | 11 | 196 | 42 | 124 | 27 | 54 | 12 | 37 | 8 | 463 | 100 |
| Toiyabe[2] | 90 | 73 | 19 | 16 | 10 | 8 | 1 | 1 | 0 | 0 | 120 | 100 |
| Total National Forest[2] | 466 | 26 | 643 | 36 | 370 | 21 | 166 | 10 | 129 | 7 | 1,774 | 100 |
| Outside National Forests: | | | | | | | | | | | | |
| Other public | 12 | 28 | 14 | 33 | 9 | 21 | 6 | 14 | 2 | 4 | 43 | 100 |
| Forest industry | 10 | 7 | 14 | 9 | 30 | 20 | 73 | 49 | 22 | 15 | 149 | 100 |
| Farmer and miscellaneous private | 97 | 31 | 88 | 27 | 55 | 17 | 56 | 17 | 24 | 8 | 320 | 100 |
| Total outside National Forests | 119 | 23 | 116 | 23 | 94 | 18 | 135 | 26 | 48 | 10 | 512 | 100 |

[1] Cubic-foot yield values shown for National Forests are based on appropriate yield tables for the major tree species but have not been adjusted for stockability limitations.

[2] Acreages shown for these National Forests include land outside the San Joaquin resource area.

The cubic-foot site classes shown in table 1 are useful for ranking the relative capacity of the land to produce wood under conditions represented by normal yield tables. They do not indicate the absolute yields that could be realized now or in the future.

Wood productivity is only one aspect of land capability relating to timber manageability. Two others are tree stockability limitations and steepness of slope. Factors that commonly limit tree stockability are soil moisture, temperature, toxicity, and physical obstructions such as rock (MacLean and Bolsinger 1973b). These factors are sometimes related to the success or failure of forest management activities, particularly regeneration (Waring et al. 1972, Fowells and Stark 1965, Griffin 1967).

Slope is related to soil erodibility and operating costs and may also affect nontimber values such as water and fisheries. In this study, slopes over 45 percent are considered difficult to manage regardless of stockability. Lands incapable of supporting 60 percent of full stocking, as shown in normal yield tables (Dahms 1964; Dunning and Reineke 1933; McArdle et al. 1961; Meyer 1961; Schumacher 1926, 1930), are considered difficult to manage regardless of slope.

Stockability and slope percent were examined on all plots established outside National Forests in the San Joaquin area. Table 11 and figure 11 show the results.

In the San Joaquin resource area, 324,000 acres or 63 percent of the commercial forest outside National Forests

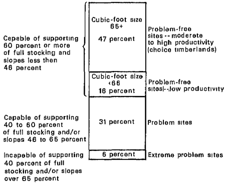
Capable of supporting 60 percent or more of full stocking and slopes less than 46 percent
Cubic-foot size 65+
47 percent
Problem-free sites -- moderate to high productivity (choice timberlands)
Cubic-foot size ‹66
16 percent
Problem-free sites--low productivity
Capable of supporting 40 to 60 percent of full stocking and/or slopes 46 to 65 percent
31 percent
Problem sites
Incapable of supporting 40 percent of full stocking and/or slopes over 65 percent
6 percent
Extreme problem sites

*Figure 11.--Medium and high site lands on flat to gently sloping ground make up 47 percent of the commercial forest outside National Forests.*

is on slopes less than 46 percent and can support 60 percent or more of full stocking. Of this, 240,000 acres or 47 percent of the total area is capable of growing at least 85 cubic feet of wood per acre per year (fig. 11). These are the choice timberlands in terms of inherent productivity and freedom from management problems.

## STOCKING CONDITION

Stocking data for National Forests are available only for reforestation backlog areas (see tabulation below). These are nonstocked lands for which reforestation funds have not been available. They amount to less than 3 percent of National Forest commercial forest lands (fig. 12).

| National Forest | Acres in reforestation backlog | Percent |
|---|---|---|
| Eldorado | 0 | 0 |
| Inyo | 1,200 | 1.0 |
| Los Padres | 900 | 5.4 |
| Sequoia | 19,400 | 4.6 |
| Sierra | 12,800 | 2.4 |
| Stanislaus | 8,600 | 1.9 |
| Toiyabe | 4,700 | 3.9 |
|  | 47,600 | 2.7 |

Stocking data for lands outside National Forests are shown in table 2. They indicate that 4 percent is nonstocked

Table 2--*Area of commercial forest land outside National Forests by growing-stock conifer stocking class, cubic-foot site class, and ownership, San Joaquin resource area, January 1, 1973*[1]

(In thousand acres)

| Growing-stock conifer stocking (percent of normal)[2] | Other public, cubic-foot site class |  | Forest industry, cubic-foot site class |  | Farms and miscellaneous private cubic-foot site class |  | All owners cubic-foot site class |  |
|---|---|---|---|---|---|---|---|---|
|  | 85+ | <85 | 85+ | <85 | 85+ | <85 | 85+ | <85 |
| 0-10 (nonstocked) | -- | 2 | -- | -- | -- | 18 | -- | 20 |
| 11-35 (lightly stocked) | 3 | 4 | 6 | 4 | 19 | 46 | 28 | 54 |
| 36-60 (moderately stocked) | 3 | 7 | 9 | 5 | 31 | 34 | 43 | 46 |
| 61+ (fully stocked) | 11 | 13 | 110 | 15 | 85 | 87 | 206 | 115 |
| All stocking classes | 17 | 26 | 125 | 24 | 135 | 185 | 277 | 235 |
| Total acres | 43 |  | 149 |  | 320 |  | 512 |  |

[1] See page 67 for definition and criteria of stocking determination.

[2] 60 percent of normal is considered full-site utilization.

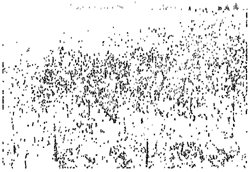

*Figure 12.--Pine plantation on old brushfield near Fish Camp, Sierra National Forest. Because of successful fire control measures and reforestation efforts, less than 3 percent of National Forest commercial forest lands are nonstocked.*

with conifers, 16 percent is lightly stocked, 17 percent is moderately stocked, and 63 percent is fully stocked.

Nonstocked lands produce little timber, but they are relatively insignificant in the San Joaquin resource area. All nonstocked lands outside National Forests are on sites incapable of growing 85 cubic feet per acre; most are below 3,000 feet in elevation (the better timberlands usually occur between 3,500 and 6,000 feet); over half are occupied to some degree by hardwoods and/or dense brush. About 90 percent of the nonstocked lands are in farmer and miscellaneous private ownership and 10 percent are in other public ownerships. No nonstocked forest industry lands were found.[19]

The nonstocked lands in farmer and miscellaneous private ownership in the San Joaquin resource area are not likely to be reforested. They are more likely to be converted to pasture.

Forest industry lands are in good condition; 84 percent are adequately stocked with conifers. Farmer and miscellaneous privately owned lands are in poorer condition; only 54 percent are adequately stocked with conifers and nearly 40 percent are at least moderately stocked with hardwoods. Other public owners, with only 43,000 acres, are represented by a small number of sample plots; hence, the reliability of the stocking data is low. The data indicate that the stocking distribution of other public lands is similar to farmer and miscellaneous private lands (see table 2).

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[19] Since the fieldwork was completed, a fire burned about 5,000 acres of forest industry land. This area is being reforested by the company owning the land.

The stocking condition of the "choice" timberlands, as defined in "Forest Land Productivity" (page 17), looks like this:

Conifer Stocking

| | |
|---|---|
| *Adequate*: | 79 percent (13 percent of this is at least moderately stocked with hardwoods) |
| *Moderate*: | 16 percent (69 percent of this is at least moderately stocked with hardwoods) |
| *Light*: | 5 percent (80 percent of this is at least moderately stocked with hardwoods) |
| *Nonstocked*: | None |

Though the choice timberlands are generally in good condition, two undesirable situations exist: high mortality in white fir and a substantial area occupied by low-volume, low-value incense-cedar and hardwood trees (fig. 13). The white fir mortality seems to be a temporary phenomenon (see "Mortality," page 26). The incense-cedar-hardwood situation, however, may have a more lasting effect.

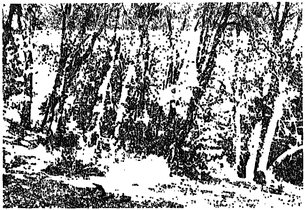

*Figure 13.--California black oak stand with scattered understory conifers, Calaveras County. Such stands may be important wildlife habitat, but they are inefficient timber producers. Stand improvement would be expensive and the returns slow in coming.*

Selective cutting in mixed conifer stands has been concentrated on the more valuable pines and firs. The former forest practice rules (California Division of Forestry 1968) allowed incense-cedar and hardwoods to be left as the predominant trees occupying stands after logging. As a result, about 40 percent of forest industry lands are now predominantly incense-cedar (30 percent) and hardwood (10 percent) type, based on plurality of stocking.

Table 27 indicates the effect of leaving incense-cedar and hardwoods. It shows that 54 percent of the softwood trees in the 2-inch diameter class are incense-cedar, and 63 percent of all species in the 2-inch class are incense-cedar and hardwood. Incense-cedar and hardwoods combined comprise the plurality through the 14-inch diameter classes. Although many hardwoods are on lower site lands at lower elevations, the stocking data show that 30 percent of the better sites are at least moderately stocked with hardwoods.

The current forest practice rules (State of California 1974) allow hardwoods and cedars to be counted as acceptable residual stocking following logging. Though the market for incense-cedar has improved over the years, this species is less efficient as a wood producer than are associated conifers. Data gathered in this study show that incense-cedar grows more slowly in diameter and is shorter than associated conifers for a given diameter. Often, it also has tapered and fluted boles resulting in lower usable volume for a given diameter and height. It occupies extensive areas where more productive species could be growing. Hardwoods often grow rapidly, but their form and space requirements limit their yield potential. No hardwoods were used in San Joaquin mills in 1972 (Howard 1974).

## STAND SIZE AND AGE

Commercial forest land in the San Joaquin resource area is occupied primarily by sawtimber stands having trees with at least a 9.0-inch d.b.h. Large, old trees are still common, but, because of the long history of selective cutting on both private and public lands, undisturbed virgin stands are confined to high rugged mountains in a few unroaded areas. Many stands are classed as uneven aged. They may contain trees ranging from a few inches to over a hundred feet high and from a few years to 300 years old.

About three-fourths of National Forest lands are stocked with sawtimber-size trees (9.0-inch d.b.h. or greater), as shown in table 3.

The forests on private lands and other public lands are comparatively young. Though 87 percent are classed as sawtimber stands (table 9), over three-fourths are less than 100 years old. The structure of these stands reflects to a large degree the forest practice rules in effect before the Z'Berg-Nejedly Forest Practice Act was passed in 1973 (State of California 1974). Those rules required that all trees 22 inches in d.b.h. or smaller (18 inches or smaller in Alpine and Mono Counties) be left in selective cutting.

Table 3--*Area of commercial forest land by stand size class in National Forests in the San Joaquin resource area, 1973*
(In thousand acres)

| National Forest | Sawtimber | Poletimber | Saplings and seedlings | Nonstocked | Total |
|---|---|---|---|---|---|
| Eldorado | 31.0 | 0 | 0 | 0 | 31.0 |
| Inyo[1] | 88.1 | .6 | 0 | 1.2 | 89.9 |
| Los Padres[1] | 67.3 | 6.6 | 2.7 | 3.9 | 80.5 |
| Sequoia | 266.9 | 136.8 | 33.2 | 19.4 | 456.3 |
| Sierra | 318.5 | 163.2 | 39.6 | 12.8 | 534.1 |
| Stanislaus | 433.1 | 1.4 | 20.7 | 8.6 | 463.8 |
| Toiyabe[1] | 112.6 | 1.2 | 1.8 | 4.7 | 120.3 |
| Total | 1,317.5 | 309.8 | 98.0 | 50.6 | 1,775.9 |
| Percent | 74 | 17 | 6 | 3 | 100 |

[1] Acreages shown for these National Forests include land outside the San Joaquin resource area.

Recent cutting has been heavier on forest industry lands than on farmer and miscellaneous private lands. This partly accounts for the larger area in uneven-aged stands on forest industry lands (75 percent of the ownership) than on farmer and miscellaneous private lands (56 percent). Most of the stands that originated after mining, burning, or logging from 1860 to 1925 were even aged until selective cutting allowed new trees to become established (Dunning and Reineke 1933). Many stands on farmer and miscellaneous private lands have not been disturbed enough to change their even-aged character.

## TIMBER VOLUME

The total estimated volume of growing stock on all ownerships in the San Joaquin resource area is about 8.3 billion cubic feet and 47.4 billion board feet (Scribner rule). About 96 percent of the cubic-foot volume and 97 percent of the board-foot volume is in softwood species.

National Forests, with 77 percent of the commercial forest area, have 83 percent of the total cubic-foot volume (fig. 14) and 86 percent of the Scribner board-foot volume.

Since 1953 the softwood sawtimber inventory on National Forests has declined about 12 percent, and the inventory on private lands has declined about 33 percent. The main cause of the reduction in inventory was removal of old-growth trees for timber products. Less important causes were fires, pests, nonforest conversions, and withdrawals.

The bulk of the volume in trees 5.0-inch d.b.h. and larger is in a few species (fig. 15).

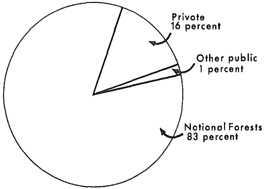

*Figure 14.--Percentage of cubic-foot volume by ownership, San Joaquin resource area, January 1, 1973.*

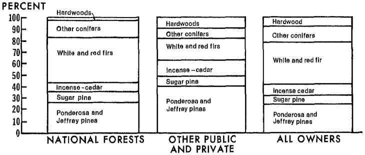

*Figure 15.--Percentage of cubic-foot volume by species and ownership class, San Joaquin resource area, January 1, 1973. Percentages for National Forests were determined on the basis of total volume in the seven National Forests lying partially or entirely within the San Joaquin resource area.*

# GROWTH AND MORTALITY

## GROWTH

Net annual growth of growing-stock trees in National Forests in the San Joaquin area is about 72 million cubic feet. Over 99 percent of this is softwoods. This gives an average of about 42 cubic feet per acre per year.

On lands outside National Forests the total estimated net annual growth is 28.9 million cubic feet (27.1 million of softwoods and 1.8 million of hardwoods). Growth of all species averages about 56 cubic feet per acre per year.

On lands outside National Forests nearly half the net annual cubic-foot growth is in ponderosa and Jeffrey pines (fig. 16).

## MORTALITY

Current annual mortality of growing-stock trees on National Forests is estimated at about 23 million cubic feet, roughly 13 cubic feet per acre.

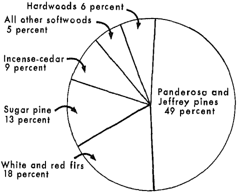

*Figure 16.--Percent of net annual cubic-foot growth by species on lands outside National Forests in the San Joaquin resource area, January 1, 1973.*

On lands outside National Forests, current annual mortality of growing-stock trees is estimated to total 5,929,000 cubic feet, about 12 cubic feet per acre. By ownership, annual mortality averages 6 cubic feet per acre on other public lands, 8 cubic feet per acre on farmer and miscellaneous private lands, and 22 cubic feet per acre on forest industry lands.

The heavy mortality on forest industry lands was mainly concentrated in smaller than average white fir (about 60 percent)--mostly in stands that had been logged in the past 10 years. Extensive logging damage had occurred in nearly all stands in which white fir mortality was high. White fir is more vulnerable to mechanical damage and subsequent attack by mortality agents than is ponderosa pine. Sunscald, bark beetles, butt rots, and top rots may all be induced by logging damage and may cause death many years later (USDA Forest Service 1965).

The high mortality is not considered a serious long-term problem. Industry lands are generally well stocked, and the white fir mortality has relatively little effect on the long-term growth in these stands. This mortality is a lost timber resource, but of relatively small magnitude. In these heavily roaded industrial timberlands more of the mortality could be salvaged, but its scattered nature and the fact that it tends to be concentrated in smaller trees makes recovery economically unattractive.

White fir and California red fir and incense-cedar have relatively high mortality rates.

| Species | Net annual cubic-foot growth as a percent of total species volume | Current annual cubic-foot mortality as a percent of total species volume |
|---|---|---|
| Ponderosa and Jeffrey pines | 2.4 | 0.4 |
| White fir and California red fir | 1.7 | .7 |
| Sugar pine | 2.8 | .1 |
| Incense-cedar | 1.5 | .8 |
| Other softwoods | 1.4 | .1 |
| Hardwoods | 1.4 | .1 |
| All species | 2.0 | .4 |

Figure 17 shows the distribution of mortality by species.

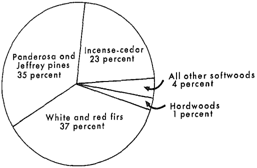

*Figure 17.--Percent of average annual mortality by species on lands outside National Forests in the San Joaquin resource area, 1973.*

For all lands outside National Forests over half the mortality was attributed to weather, insects, diseases, and logging.

Cubic-foot mortality

| Cause | Percent |
|---|---|
| Weather | 19 |
| Insects | 18 |
| Disease | 10 |
| Logging | 9 |
| Suppression | 5 |
| Animals | 1 |
| Unclassified or unknown | 38 |
|  | 100 |

Mortality statistics shown are only for trees 5.0 inches in d.b.h. and larger. Though mortality of smaller trees is insignificant from a volume standpoint, it is significant to successful timber management. Many insects, diseases, animals, and other agents that have little effect on large trees do, however, kill millions of small trees annually. Small trees are becoming more important as larger acreages are placed under young-growth management.

# TIMBER HARVEST AND CONSUMPTION AND INDUSTRIAL EMPLOYMENT

## TIMBER HARVEST

Annual timber harvest in the San Joaquin resource area has remained fairly constant at 400 million to 600 million board feet for more than 25 years (California Division of Forestry 1947-75). The 1972 cut--596 million board feet--was about 12 percent of California's total.

National Forests have contributed an increasing proportion of the timber harvested as the cut on private lands has decreased. In 1953, the National Forest cut was 26 percent of the total, compared with 84 percent in 1973 (fig. 18). In 1973 other public lands provided about 1 percent and private lands 15 percent.

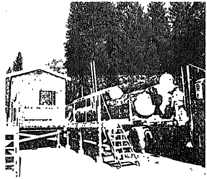

*Figure 18.--Timber from National Forests, such as that shown at this U.S. Forest Service scaling station, amounts to over 80 percent of the total timber processed by mills in the San Joaquin resource area.*

With the shift in cut overtime from private to public lands has come some redistribution of cut by county. In Fresno, Madera, Kern,[20] and Tulare Counties in the southern part of the area, the cut was increased by over 100 million board feet. In Calaveras County in the north, the cut dropped nearly as much as it increased in the four southern counties.

## LOG CONSUMPTION

In 1972, about 600 million board feet of logs were processed by forest products industries in the San Joaquin resource area. Logs were used by 28 lumber mills,[21] 2 veneer and plywood mills, 2 post-pole-piling plants, and an export facility (Howard 1974). Two pulp and board plants also operated in the area; they used residues in the form of chips, sawdust, shavings, and bark from other mills.

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[20] Includes small amount in Ventura County.

[21] In 1976 there were 21 lumber mills in the area.

A considerable shift in the species mix has also occurred, as shown in table 4.

More changes may occur in the future. The high current growth rates in ponderosa, Jeffrey, and sugar pines suggest that the availability of these species may hold steady or increase. Table 27, however, shows more incense-cedar, white fir, and hardwoods in the small diameter classes.

Historical data, along with current inventory and growth data, suggest cycles in which pines are plentiful alternated with cycles in which other species are plentiful.

Nontimber developments at the lower elevations where ponderosa pine stands predominate may eventually reduce the availability of this species. Changing market conditions and/or changing availability could bring about the use of some unused "other conifers" that make up 14 percent of the inventory.

Table 4--*Timber consumption by species, San Joaquin resource area, 1946, 1956, 1962, 1968, and 1972*[1]

(In percent)

| Year | Ponderosa, Jeffrey, and sugar pines | White and red firs | Douglas-fir | Incense-cedar | Other species | Total |
|---|---|---|---|---|---|---|
| 1946 | 67 | 25 | 4 | 4 | -- | 100 |
| 1956 | 53 | 39 | 1 | 5 | 2 | 100 |
| 1962 | 59 | 34 | 2 | [2]5 | [2] | 100 |
| 1968 | 47 | 47 | 2 | [2]4 | [2] | 100 |
| 1972 | 43 | 44 | 1 | 12 | -- | 100 |

[1] Sources: Forest Survey Release 6 (Burks et al. 1948).
Forest Survey Release 35 (May and Baker 1958).
California Timber Industries--1968 (Barrette et al. 1970).
Resource Bulletin PNW-52 (Howard 1974).
Resource Bulletin PSW-2 (Muerle and Hornibrook).

[2] Incense-cedar and other species combined.

EMPLOYMENT IN FOREST INDUSTRIES

Employment in forest industries in the San Joaquin resource area totaled 8,864 persons in 1972 and 9,228 in 1975.[22] This is about 10 percent of the total reported forest industrial employment in California.[23]

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[22] Standard industrial codes 2411-2499 and 2611-2661, U.S. Office of Management and Budget (1972).

[23] Source: State of California, Employment Development Department.

In the 14 counties as a whole, forest industries contribute only 2 percent to total employment and 11 percent to manufacturing employment. For some counties and especially for certain mountain communities, forest industries provide a significant portion of total employment.

The reported forest industrial employment includes employment in milling and logging, but excludes some trucking. Forestry positions in government agencies and companies not classified as wood products industry are also excluded. Of the forest industrial employment, logging accounted for 4 percent, sawing and planing mills 28 percent, all paper and allied products 27 percent, and veneer and plywood and all others 41 percent.

Total forest industrial employment has increased from about 7,300 in the early 1960's to over 9,000 in 1974. The major increase has been in paper and allied products and wood products manufacturing other than sawing and planing (fig. 19). New and expanded facilities are responsible for the increase.

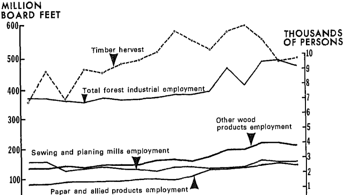

*Figure 19.--Timber harvest and forest industrial employment, San Joaquin resource area, 1960-75.*

# FUTURE TIMBER SUPPLIES

National Forests provide over 80 percent of the timber processed by mills in the San Joaquin resource area and are therefore the key to a continued supply of industrial wood. The future allowable timber harvest from National Forests can be expected to change as new data on yields and management response become available, and as land use policies evolve.

The best estimate of current sawtimber growth is about 285 million board feet (Scribner rule). The annual yield targets are based on the estimated potential yield for each commercial forest component. They are not necessarily in balance with the current growth because of unequal age class distribution, overmature timber stands, and poor stocking condition of stands not yet placed under management. Table 5 shows the total potential yield and net annual growth estimates for the five National Forests that make up the bulk of the commercial forest in the San Joaquin resource area.

Table 5--*Potential yield and net annual growth*[1/] *by National Forest and commercial forest land component, San Joaquin resource area, California*

(In million board feet, Scribner rule)

| National Forest | Commercial forest | | | | | Current net annual growth |
|---|---|---|---|---|---|---|
| | Standard | Special | Marginal | Unregulated | Total | |
| Inyo | 8.1 | 0.1 | 3.3 | -- | 11.5 | 12.5 |
| Sequoia | 104.5 | 7.0 | 6.6 | -- | 118.1 | 49.1 |
| Sierra | 141.9 | 9.7 | 8.3 | -- | 159.9 | 49.9 |
| Stanislaus | 120.1 | 10.1 | 26.8 | 5.0 | 162.0 | 162.3 |
| Toiyabe | 12.4 | .2 | 10.2 | .2 | 23.0 | 12.6 |
| Total | 387.0 | 27.1 | 55.2 | 5.2 | 474.5 | 279.4 |

[1/] USDA Forest Service 1976.

In 1972, 474.8 million board feet of National Forest timber was processed in mills in the area (Howard 1974), nearly identical to the total potential yield from all commercial forest components.

Since the full yield potential can usually be cut only from the standard component, the actual cut will normally be less than the total yield potential from all components. National Forest cut has declined since 1972.

The reasons include shortage of administration funds and personnel and delays caused by land use planning and litigation.

National Forest timber cut may decline even further if wilderness areas increase. In addition to the 17,000 acres of productive forest in deferred areas being studied for wilderness inclusion, about 137,000 acres of productive forest in roadless areas are to be reviewed for possible Wilderness designation. Estimated timber volume in these areas is 3 billion board feet, and potential yield is about 39 million board feet per year, about 8 percent of the total for National Forests in the San Joaquin resource area. How much of this will be removed from the timber-producing portion of the forest remains to be seen.

The National Forests, though managed for many resources other than timber, are the only lands for which timber production is ordered by law (National Forest Management Act of 1976). The law does not specify an exact amount of timber to be produced. In fact, it outlines conditions that must be met before harvest levels can be increased; it also specifies situations under which harvest levels must be decreased. Before the longrun timber productivity of these lands can be determined, more information on management techniques and response, resource interactions, and demand for the various outputs is needed.

Farmer and miscellaneous privately owned lands are producing considerably less wood than they could. Although their growth is three times their cutting rate and their inventories are larger than forest industry's, they are supplying about 25 percent less timber to mills. Many opportunities exist to produce more wood from these lands, but many owners apparently have objectives other than growing timber.

Recreational-residential development and forest clearing for grazing continue to reduce the timber-growing area in farmer and miscellaneous private ownerships. The forest area estimates in this report include tracts of land being developed for nontimber use when the fieldwork for this report was done. Clearing or construction work had begun in the immediate vicinity of many sample plots, but the plots had not yet been converted to nonforest. These potential conversions, based on the sample, amounted to 40,000 acres and contained 280 million board feet of softwood timber (Scribner rule), about 9 percent of the area and 5 percent of the volume in all private ownerships. The growth loss by these conversions will be about 2.4 million cubic feet annually or 9 percent of the net annual growth on all private lands.

About 60 percent of the conversions were for recreational-residential development, and 40 percent were for grazing or other agricultural use. Recreational-residential developments were often at the midelevations, and, on the average, replaced better quality timberland than grazing clearings which were generally in the lower forest fringe zone. The average productive capacity of the recreational-residential sites was 74 cubic feet per acre per year compared with 44 cubic feet for the grazing developments. Projected increased demand for meat and predicted losses of Central Valley grazing lands (California Department of Water Resources 1974) to agriculture and urban developments indicate that there will be a growing demand for pasture. Since livestock grazing will yield quicker returns than timber, a continued loss of forest to pasture clearing can be expected.

Predicting the future of recreational and residential development in forest areas is difficult. It appears these developments will continue, and, in some areas, they may usurp use of the land for grazing as well as for timber.

On forest industry lands growth and cut are nearly equal. For several decades the mixed-age stands have been yielding timber, mostly on a selective cut basis. It appears they could continue to do so indefinitely. Some changes in the resource situation should be considered. Included are a growing scarcity of large trees and a changing mix of species. Incense-cedar and hardwoods may become a management problem in some areas.

Though growth and cut are nearly in balance, forest industry lands are apparently producing less than their potential. If investments were made to increase yields on these lands, the payoff would be decades from now. In the meantime, pressures for developing other private lands for nontimber use may begin to erode the forest industrial land base.

The continued loss of forest accentuates the importance of intensive management of remaining forest lands. If the 240,000 acres of "choice" timberlands (see page 20) in private ownerships were managed so that they produced only 80 percent of their estimated potential, they could yield 25 million cubic feet annually. This is roughly equal to the current growth on the entire 512,000 acres of commercial forest outside National Forests, and 15 to 20 percent greater than the current timber harvest.

There seems little incentive for private landowners in the San Joaquin area to make forestry investments. Land use trends suggest, however, that intensified forest management on lands dedicated to timber production is needed to prevent a timber shortage in the future.

*Table 6--Area by land class for all National Forests and for all lands outside National Forest by county, San Joaquin resource area, California, January 1, 1973*

(In thousand acres)

| Land class | National Forests | Outside National Forests | | | | | | | | | | | | | | | | Total[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Alpine | Amador | Calaveras | Fresno | Kern | Kings | Madera | Mariposa | Merced | Mono | San Joaquin | Stanislaus | Tulare | Tuolumne | | |
| Forest land: | | | | | | | | | | | | | | | | | | |
| Commercial | 1,733 | 512 | 18 | 64 | 134 | 36 | 35 | -- | 15 | 45 | -- | 7 | -- | -- | 43 | 115 | | 2,245 |
| Deferred | 17 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | | 17 |
| Productive reserved | 39 | 614 | 1 | [2] | 2 | 72 | -- | -- | 37 | 115 | -- | -- | -- | -- | 184 | 203 | | 654 |
| Unproductive | 1,101 | 2,937 | 24 | 112 | 253 | 363 | 531 | 12 | 193 | 361 | 37 | 61 | 26 | 117 | 551 | 296 | | 4,038 |
| Total | 2,890 | 4,064 | 43 | 176 | 389 | 471 | 567 | 12 | 247 | 521 | 37 | 68 | 26 | 117 | 779 | 614 | | 6,954 |
| Nonforest land | 627 | 14,149 | 25 | 130 | 180 | 2,369 | 4,295 | 881 | 726 | 228 | 1,215 | 717 | 879 | 847 | 1,430 | 224 | | 14,776 |
| Unproductive forest and nonforest (unclassified) | 1,586 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | | 1,586 |
| Total area[1] | 5,103 | 18,213 | 68 | 306 | 569 | 2,840 | 4,862 | 893 | 973 | 749 | 1,252 | 785 | 905 | 964 | 2,209 | 838 | | 23,316 |

Source: United States Bureau of the Census, Land and Water Area of the United States, 1971

[1] Totals may be off because of rounding.

[2] Less than 500 acres.

Table 7--*Area of commercial forest land by ownership, San Joaquin resource area, California, January 1, 1973*

| Ownership | Thousand acres | Percent |
|---|---|---|
| National Forest | 1,733 | 77.2 |
| Other public: | | |
| Bureau of Land Management | 22 | 1.0 |
| Bureau of Indian Affairs | 13 | .6 |
| State | 7 | .3 |
| County and municipal | 1 | -- |
| Total other public | 43 | 1.9 |
| Private: | | |
| Forest industry | 149 | 6.6 |
| Farmer | 102 | 4.6 |
| Miscellaneous private--corporate | 87 | 3.9 |
| Miscellaneous private--noncorporate | 131 | 5.8 |
| Total private | 469 | 20.9 |
| Total all ownerships | 2,245 | 100.0 |

Table 8--*Area of commercial forest land outside National Forests, by county and ownership, San Joaquin resource area, California, January 1, 1973*

(In thousand acres)

| County | Other public | Private | Total |
|---|---|---|---|
| Alpine | 2 | 16 | 18 |
| Amador | 1 | 63 | 64 |
| Calaveras | 8 | 126 | 134 |
| Fresno | 1 | 35 | 36 |
| Kern | 1 | 34 | 35 |
| Madera | -- | 15 | 15 |
| Mariposa | 1 | 44 | 45 |
| Mono | 1 | 6 | 7 |
| Tulare | 21 | 22 | 43 |
| Tuolumne | 7 | 108 | 115 |
| All counties | 43 | 469 | 512 |

Table 9--*Area of commercial forest land outside National Forests, by stand-size class, San Joaquin resource area, California, January 1, 1973*

| Stand-size class | Thousand acres |
|---|---|
| Sawtimber stands: | |
| Large sawtimber[1] | 197 |
| Small sawtimber[2] | 247 |
| Total | 444 |
| Poletimber stands | 9 |
| Sapling and seedling stands | 50 |
| Nonstocked areas | 9 |
| All classes | 512 |

[1] Large sawtimber includes trees 21.0 inches in d.b.h. and larger.

[2] Small sawtimber includes softwood trees 9.0 to 20.9 inches in d.b.h. and hardwood trees 11.0 to 20.9 inches in d.b.h.

Table 10--*Area of commercial forest land outside National Forests by stocking percent, stand component, and cubic-foot site class, San Joaquin resource area, California, January 1, 1973*

(In thousand acres)

| Stocking percent in softwood growing-stock trees | Stocking percent in hardwood and cull softwood trees | | | | | |
|---|---|---|---|---|---|---|
| | 0-10 percent | 11-35 percent | 36-60 percent | 61-80 percent | 81+ percent | Total[1] |
| 0-10 percent: | | | | | | |
| High site[2] | 0 | 0 | 0 | 0 | 0 | 0 |
| Medium site | 0 | 0 | 0 | 0 | 0 | 0 |
| Low site | 10 | 7 | 2 | 0 | 1 | 20 |
| Total | 10 | 7 | 2 | 0 | 1 | 20 |
| 11-35 percent: | | | | | | |
| High site | 0 | 2 | 3 | 0 | 0 | 5 |
| Medium site | 0 | 5 | 7 | 0 | 11 | 23 |
| Low site | 11 | 8 | 18 | 12 | 5 | 54 |
| Total | 11 | 15 | 28 | 12 | 16 | 82 |
| 36-60 percent: | | | | | | |
| High site | 2 | 0 | 3 | 0 | 0 | 5 |
| Medium site | 4 | 4 | 10 | 20 | 0 | 38 |
| Low site | 12 | 8 | 11 | 5 | 9 | 45 |
| Total | 18 | 12 | 24 | 25 | 9 | 88 |
| 61-80 percent: | | | | | | |
| High site | 0 | 1 | 3 | 0 | 0 | 4 |
| Medium site | 6 | 11 | 15 | 5 | 0 | 37 |
| Low site | 8 | 7 | 10 | 0 | 0 | 25 |
| Total | 14 | 19 | 28 | 5 | 0 | 66 |
| 81+ percent: | | | | | | |
| High site | 21 | 14 | 0 | 0 | 0 | 35 |
| Medium site | 70 | 53 | 7 | 0 | 0 | 130 |
| Low site | 44 | 37 | 10 | 0 | 0 | 91 |
| Total | 135 | 104 | 17 | 0 | 0 | 256 |
| Total: | | | | | | |
| High site | 23 | 16 | 9 | 0 | 0 | 48 |
| Medium site | 80 | 73 | 40 | 25 | 11 | 229 |
| Low site | 85 | 67 | 50 | 18 | 15 | 235 |
| Total[1] | 188 | 156 | 99 | 43 | 26 | 512 |

[1] Totals may be off because of rounding.

[2] High site = 165 cubic feet per acre per year; medium site = 85 to 164 cubic feet per acre per year; low site = 20 to 84 cubic feet per acre per year.

Table 11--*Area of commercial forest land outside National Forests by stockability limitation class, slope percent, and cubic-foot site class, San Joaquin resource area, California, January 1, 1973*

| Slope | Site class | Stockability limitation--percent of normal | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 80 to 100 (no problem) | | 60 to 80 (moderate problem) | | 40 to 60 (serious problem) | | Less than 40 (extreme problem) | | Total | |
| Percent | Cubic feet | Thousand acres | Percent of area | Thousand acres | Percent of area | Thousand acres | Percent of area | Thousand acres | Percent of area | Thousand acres | Percent of area |
| 0 to 45 (flat to gentle) | 85+ | 218 | 42.7 | 22 | 4.3 | 3 | .5 | -- | -- | 243 | 47.5 |
| | <85 | 54 | 10.6 | 30 | 5.8 | 85 | 16.7 | 17 | 3.4 | 186 | 36.5 |
| 46 to 65 (steep) | 85+ | 31 | 6.1 | -- | -- | -- | -- | -- | -- | 31 | 6.1 |
| | <85 | 6 | 1.2 | 15 | 2.9 | 17 | 3.4 | -- | -- | 38 | 7.4 |
| 66+ (very steep) | 85+ | 3 | .5 | -- | -- | -- | -- | -- | -- | 3 | .5 |
| | <85 | 3 | .5 | 3 | .5 | 5 | 1.0 | -- | -- | 11 | 2.0 |
| All slopes | 85+ | 252 | -- | 22 | -- | 3 | -- | -- | -- | 277 | -- |
| | <85 | 63 | -- | 48 | -- | 107 | -- | 17 | -- | 235 | -- |
| Total | | 315 | 62 | 70 | 14 | 110 | 21 | 17 | 3 | 512 | 100.0 |

Table 12--*Area of commercial forest land outside National Forests, by forest type, San Joaquin resource area, California, January 1, 1973*

(In thousand acres)

| Forest type | All ownerships |
|---|---|
| Douglas-fir | 9 |
| White fir | 63 |
| California red fir | 1 |
| Ponderosa pine | 169 |
| Jeffrey pine | 40 |
| Sugar pine | 11 |
| Lodgepole pine | 5 |
| Giant sequoia | 2 |
| Incense-cedar | 90 |
| California black oak | 56 |
| California white oak and madrone | 13 |
| Other hardwoods[1] | 44 |
| Nonstocked | 9 |
| All types | 512 |

[1] Primarily canyon live oak, white alder, and bigleaf maple.

Table 13--*Area of productive reserved forest land by forest type and ownership, San Joaquin resource area, California, January 1, 1973*

(In thousand acres)

| Forest type | National Forest | National, State, and county parks | Total |
|---|---|---|---|
| Douglas-fir | -- | 82 | 82 |
| White and California red firs | 31 | 191 | 222 |
| Ponderosa and Jeffrey pines | 6 | 161 | 167 |
| Sugar pine | -- | 53 | 53 |
| Lodgepole pine | 1/ | 96 | 96 |
| Giant sequoia | -- | 7 | 7 |
| Other conifers 2/ | 2 | 6 | 8 |
| California black oak | -- | 14 | 14 |
| Other hardwoods 3/ | -- | 5 | 5 |
| Total | 39 | 615 | 654 |

1/ Less than 500 acres.

2/ 6,000 acres of western white pine, 1,000 acres of mountain hemlock, and 1,000 acres of incense-cedar.

3/ 1,000 acres of white alder, 3,000 acres of aspen, 1,000 acres of cottonwood, and less than 500 acres of California laurel.

Table 14--*Area of unproductive forest land in National Forests; in National, State, and county parks; in other public ownership outside parks; and in private ownership, by type or category, San Joaquin resource area, California, January 1, 1973*

(In thousand acres)

| Type or category | National Forests 1/ | | National, State, and county parks | Other public outside parks | Private | Total |
|---|---|---|---|---|---|---|
| | In wilderness | Not in wilderness | | | | |
| Rocky | -- | -- | 355 | -- | 13 | 368 |
| Low site | -- | -- | -- | 6 | 42 | 48 |
| Pinyon-juniper | -- | 121 | 40 | 101 | 30 | 292 |
| Oak 2/ | -- | -- | 36 | 253 | 1,549 | 1,838 |
| Chaparral | -- | -- | 82 | 152 | 278 | 512 |
| Type unspecified | 288 | 692 | -- | -- | -- | 980 |
| Total | 288 | 813 | 513 | 512 | 1,912 | 4,038 |

1/ These figures do not include 1,586,000 acres of unproductive forest land and nonforest land on National Forests.

2/ Primarily blue oak, canyon live oak, interior live oak, and California white oak.

Table 15--*Area of commercial forest land; and net volume, net annual growth, and average annual mortality of growing stock and sawtimber outside National Forests, by stand age class, San Joaquin resource area, California, January 1, 1975*

| Stand age class | Area | Net volume |  | Net annual growth |  | Average annual mortality |  |
|---|---|---|---|---|---|---|---|
|  |  | Growing stock | Sawtimber | Growing stock | Sawtimber | Growing stock | Sawtimber |
| Years | Thousand acres | Million cubic feet | Million board feet[1] | Thousand cubic feet | Thousand board feet[1] | Thousand cubic feet | Thousand board feet[1] |
| Nonstocked: | 9 | [2] | 2 | 5 | 19 | -- | -- |
| 0-9 | 26 | 19 | 100 | 446 | 2,424 | 111 | 720 |
| 10-19 | -- | -- | -- | -- | -- | -- | -- |
| 20-29 | 2 | -- | -- | -- | -- | -- | -- |
| 30-39 | 11 | 5 | 24 | 296 | 1,359 | -- | -- |
| 40-49 | 10 | 28 | 98 | 1,210 | 4,322 | 21 | -- |
| 50-59 | 22 | 47 | 218 | 2,165 | 12,459 | 132 | 486 |
| 60-69 | 14 | 34 | 164 | 1,268 | 7,103 | 12 | -- |
| 70-79 | 36 | 122 | 671 | 2,792 | 20,575 | 797 | 2,753 |
| 80-89 | 17 | 67 | 399 | 1,124 | 8,344 | 724 | 4,252 |
| 90-99 | 33 | 54 | 284 | 1,644 | 10,484 | 123 | 551 |
| 100-119 | 4 | 35 | 240 | -14 | 96 | 654 | 4,657 |
| 120-139 | -- | -- | -- | -- | -- | -- | -- |
| 140-159 | -- | -- | -- | -- | -- | -- | -- |
| 160-179 | 4 | 3 | 18 | 92 | 622 | -- | -- |
| 180-199 | -- | -- | -- | -- | -- | -- | -- |
| 200 and over | 2 | 42 | 227 | 156 | 677 | -- | -- |
| Uneven-aged: |  |  |  |  |  |  |  |
| 0-49 | 83 | 131 | 664 | 4,092 | 18,004 | 253 | 1,196 |
| 50-99 | 147 | 481 | 2,649 | 9,490 | 55,772 | 1,692 | 9,544 |
| 100+ | 91 | 372 | 2,266 | 4,159 | 33,158 | 1,409 | 8,425 |
| All classes[3] | 512 | 1,441 | 8,024 | 28,923 | 175,418 | 5,929 | 32,582 |

[1] International 1/4-inch rule.

[2] Less than 500,000 cubic feet.

[3] Totals may be off because of rounding.

Table 16--*Net volume of growing stock and sawtimber on commercial forest land and average volume per acre, by ownership and softwoods and hardwoods, San Joaquin resource area, California, January 1, 1973*

| Ownership class | Average volume per acre | Softwoods | Hardwoods | All species |
|---|---|---|---|---|
| | Cubic feet | - - - - - | Million cubic feet | - - - - - |
| Growing stock:[1] | | | | |
| National Forest | 3,942 | 6,592 | 240 | 6,832 |
| Other public | 3,000 | 113 | 16 | 129 |
| Private | 2,799 | 1,199 | 114 | 1,313 |
| **Total** | 3,685 | 7,904 | 370 | 8,274 |
| | Board feet | - - - - - | Million board feet | - - - - - |
| Sawtimber (International 1/4-inch rule):[2] [3] | | | | |
| Other public | 15,581 | 636 | 34 | 670 |
| Private | 15,678 | 7,071 | 282 | 7,353 |
| Total | 15,670 | 7,707 | 316 | 8,023 |
| Sawtimber (Scribner rule):[4] | | | | |
| National Forest | 23,406 | 39,487 | 1,075 | 40,562 |
| Other public | 14,070 | 572 | 33 | 605 |
| Private | 13,200 | 5,913 | 278 | 6,191 |
| Total | 21,094 | 45,972 | 1,386 | 47,357 |

[1] Includes trees 5.0 inches in d.b.h. and larger.

[2] Includes softwood trees 9.0 inches in d.b.h. and larger, and hardwood trees 11.0 inches in d.b.h. and larger.

[3] International 1/4-inch volume data not available for all National Forests within the San Joaquin resource area.

[4] Includes trees 11.0 inches in d.b.h. and larger.

Table 17--*Net volume of growing stock and sawtimber on commercial forest land outside National Forests, by forest type, San Joaquin resource area, California, January 1, 1973*

| Forest type | Growing stock | Sawtimber | |
|---|---|---|---|
| | | International 1/4-inch rule | Scribner rule |
| | Million cubic feet | - - Million board feet - - | |
| Douglas-fir | 65 | 464 | 348 |
| White fir | 287 | 1,794 | 1,529 |
| California red fir | 1 | 6 | 5 |
| Ponderosa pine | 478 | 2,598 | 2,206 |
| Jeffrey pine | 72 | 411 | 340 |
| Sugar pine | 52 | 319 | 279 |
| Lodgepole pine | 20 | 107 | 88 |
| Giant sequoia | 42 | 227 | 219 |
| Incense-cedar | 260 | 1,361 | 1,138 |
| California black oak | 84 | 363 | 322 |
| California white oak | 13 | 69 | 62 |
| Pacific madrone | 5 | 18 | 15 |
| Other hardwoods[1] | 61 | 283 | 245 |
| Nonstocked | [2] | [3] | [3] |
| All types[4] | 1,441 | 8,024 | 6,796 |

[1] Primarily canyon live oak, white alder, and bigleaf maple.

[2] Less than 500,000 cubic feet.

[3] Less than 500,000 board feet.

[4] Totals may be off because of rounding.

Table 18--*Net volume of growing stock and sawtimber on commercial forest land outside National Forests by county and ownership, San Joaquin resource area, California, January 1, 1973*

| County | Other public | Private | Total[1] |
|---|---|---|---|
|  | Million cubic feet |  |  |
| Growing stock:[2] |  |  |  |
| Alpine | 2 | 36 | 38 |
| Amador | 1 | 217 | 218 |
| Calaveras | 16 | 344 | 360 |
| Fresno | 5 | 117 | 122 |
| Kern | 2 | 73 | 74 |
| Madera | -- | 33 | 34 |
| Mariposa | 3 | 103 | 105 |
| Mono | -- | 17 | 17 |
| Tulare | 93 | 48 | 141 |
| Tuolumne | 8 | 325 | 331 |
| Total[1] | 130 | 1,313 | 1,443 |
|  | Million board feet |  |  |
| Sawtimber (International 1/4-inch rule):[3] |  |  |  |
| Alpine | 11 | 199 | 210 |
| Amador | 5 | 1,303 | 1,308 |
| Calaveras | 84 | 1,944 | 2,028 |
| Fresno | 23 | 663 | 686 |
| Kern | 10 | 375 | 385 |
| Madera | -- | 175 | 175 |
| Mariposa | 13 | 538 | 551 |
| Mono | -- | 94 | 94 |
| Tulare | 483 | 259 | 742 |
| Tuolumne | 41 | 1,803 | 1,844 |
| Total[1] | 670 | 7,353 | 8,023 |
| Sawtimber (Scribner rule):[4] |  |  |  |
| Alpine | 10 | 163 | 173 |
| Amador | 5 | 1,067 | 1,072 |
| Calaveras | 73 | 1,651 | 1,724 |
| Fresno | 21 | 562 | 583 |
| Kern | 9 | 321 | 330 |
| Madera | -- | 150 | 150 |
| Mariposa | 10 | 456 | 466 |
| Mono | -- | 79 | 79 |
| Tulare | 444 | 215 | 659 |
| Tuolumne | 34 | 1,526 | 1,560 |
| Total[1] | 606 | 6,190 | 6,796 |

[1] Totals may be off because of rounding.

[2] Includes trees 5.0 inches in d.b.h. and larger.

[3] Includes softwood trees 9.0 inches in d.b.h. and larger, hardwood trees 11.0 inches in d.b.h. and larger.

[4] Includes trees 11.0 inches in d.b.h. and larger.

Table 19--*Net volume of growing stock and sawtimber on commercial forest land outside National Forests and average volume per acre, by stand-size class and by softwoods and hardwoods, San Joaquin resource area, California, January 1, 1973*

| Stand-size class | Average volume per acre | Softwoods | Hardwoods | All species[1] |
|---|---|---|---|---|
| | Cubic feet | - - - - - Million cubic feet | - - - - - | |
| Growing stock:[2] | | | | |
| Large sawtimber stands | 3,802 | 707 | 42 | 749 |
| Small sawtimber stands | 2,668 | 576 | 82 | 659 |
| Poletimber stands | 556 | 2 | 3 | 5 |
| Sapling and seedling stands | 580 | 27 | 2 | 29 |
| Nonstocked areas | -- | [3] | [3] | [3] |
| Total[1] | 2,814 | 1,312 | 130 | 1,441 |
| | Board feet | - - - - - Million board feet | - - - - - | |
| Sawtimber (International 1/4-inch rule):[4] | | | | |
| Large sawtimber stands | 23,503 | 4,514 | 116 | 4,630 |
| Small sawtimber stands | 13,126 | 3,050 | 192 | 3,242 |
| Poletimber stands | 1,222 | 8 | 3 | 11 |
| Sapling and seedling stands | 2,780 | 134 | 5 | 139 |
| Nonstocked areas | 222 | 1 | 1 | 2 |
| Total[1] | 15,672 | 7,707 | 317 | 8,024 |
| Sawtimber (Scribner rule):[5] | | | | |
| Large sawtimber stands | 20,599 | 3,944 | 114 | 4,058 |
| Small sawtimber stands | 10,595 | 2,429 | 188 | 2,617 |
| Poletimber stands | 1,000 | 7 | 3 | 9 |
| Sapling and seedling stands | 2,200 | 105 | 5 | 110 |
| Nonstocked areas | 222 | 1 | 1 | 2 |
| Total[1] | 13,273 | 6,485 | 311 | 6,796 |

[1] Totals may be off because of rounding.

[2] Includes trees 5.0 inches in d.b.h. and larger.

[3] Less than 500,000 cubic feet.

[4] Includes softwood trees 9.0 inches in d.b.h. and larger, and hardwood trees 11.0 inches in d.b.h. and larger.

[5] Includes trees 11.0 inches in d.b.h. and larger.

Table 20--*Net volume of growing stock on commercial forest land outside National Forests, by species and ownership, San Joaquin resource area, California, January 1, 1973*

(In million cubic feet)

| Species | Other public | Private | Total[1] |
|---|---|---|---|
| Softwoods: | | | |
| Douglas-fir | 1 | 68 | 69 |
| White fir | 17 | 257 | 274 |
| California red fir | -- | 28 | 28 |
| Ponderosa pine | 26 | 471 | 497 |
| Jeffrey pine | 2 | 83 | 85 |
| Sugar pine | 17 | 113 | 130 |
| Lodgepole pine[2] | -- | 20 | 20 |
| Giant sequoia | 38 | -- | 38 |
| Incense-cedar | 12 | 159 | 171 |
| Total softwoods[1] | 113 | 1,199 | 1,312 |
| Hardwoods: | | | |
| White alder[3] | -- | 10 | 10 |
| Black oak | 15 | 77 | 92 |
| Other hardwoods[4] | 1 | 24 | 25 |
| Total hardwoods[1] | 16 | 114 | 130 |
| All species[1] | 129 | 1,312 | 1,441 |

[1] Totals may be off because of rounding.

[2] Includes 2 million cubic feet of eastern white pine and mountain hemlock.

[3] Includes bigleaf maple, cottonwood, and aspen.

[4] Includes canyon live oak, interior live oak, California white oak, and madrone.

Table 21--*Net volume of sawtimber on commercial forest land outside National Forests, by species and ownership, San Joaquin resource area, California, January 1, 1973 (International 1/4-inch rule)*

(In million board feet)

| Species | Other public | Private | Total[1] |
|---|---|---|---|
| Softwoods: | | | |
| Douglas-fir | 5 | 468 | 473 |
| White fir | 102 | 1,687 | 1,789 |
| California red fir | -- | 174 | 174 |
| Ponderosa pine | 152 | 2,712 | 2,864 |
| Jeffrey pine | 11 | 495 | 506 |
| Sugar pine | 109 | 684 | 793 |
| Lodgepole pine[2] | -- | 95 | 95 |
| Giant sequoia | 196 | -- | 196 |
| Incense-cedar | 61 | 755 | 816 |
| Total softwoods[1] | 636 | 7,071 | 7,707 |
| Hardwoods: | | | |
| White alder[3] | -- | 28 | 28 |
| Black oak | 31 | 203 | 234 |
| Other hardwoods[4] | 2 | 53 | 55 |
| Total hardwoods[1] | 34 | 284 | 317 |
| All species[1] | 670 | 7,354 | 8,024 |

[1] Totals may be off because of rounding.

[2] Includes 2 million board feet of eastern white pine and mountain hemlock.

[3] Includes bigleaf maple, cottonwood, and aspen.

[4] Includes canyon live oak, interior live oak, California white oak, and madrone.

Table 22--*Net volume of sawtimber on commercial forest land outside National Forests, by species and ownership, San Joaquin resource area, California, January 1, 1973 (Scribner rule)*

(In million board feet)

| Species | Other public | Private | Total[1/] |
|---|---|---|---|
| Softwoods: | | | |
| Douglas-fir | 4 | 341 | 345 |
| White fir | 86 | 1,420 | 1,506 |
| California red fir | -- | 154 | 154 |
| Ponderosa pine | 132 | 2,321 | 2,453 |
| Jeffrey pine | 10 | 419 | 429 |
| Sugar pine | 100 | 601 | 701 |
| Lodgepole pine[2/] | -- | 74 | 74 |
| Giant sequoia | 192 | -- | 192 |
| Incense-cedar | 50 | 581 | 631 |
| Total softwoods[1/] | 572 | 5,913 | 6,485 |
| Hardwoods: | | | |
| White alder[3/] | -- | 28 | 28 |
| Black oak | 31 | 199 | 230 |
| Other hardwoods[4/] | 2 | 51 | 53 |
| Total hardwoods[1/] | 33 | 278 | 311 |
| All species[1/] | 605 | 6,191 | 6,796 |

[1/] Totals may be off because of rounding.

[2/] Includes 2 million board feet of eastern white pine and mountain hemlock.

[3/] Includes bigleaf maple, cottonwood, and aspen.

[4/] Includes canyon live oak, interior live oak, California white oak, and madrone.

Table 23--*Net volume of growing stock on commercial forest land outside National Forests, by species and diameter class, San Joaquin resource area, California, January 1, 1973*

(In million cubic feet)

| Species | Diameter class (inches at breast height) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5.0-6.9 | 7.0-8.9 | 9.0-10.9 | 11.0-12.9 | 13.0-14.9 | 15.0-16.9 | 17.0-18.9 | 19.0-20.9 | 21.0-28.9 | 29.0-38.9 | 39.0 and larger | All classes[1] |
| Softwoods: | | | | | | | | | | | | |
| Douglas-fir | 2 | 1 | 4 | 4 | 5 | 5 | 7 | 3 | 17 | 6 | 15 | 69 |
| White fir | 4 | 7 | 9 | 16 | 11 | 21 | 20 | 21 | 92 | 56 | 16 | 274 |
| California red fir | -- | -- | -- | 1 | 1 | -- | -- | 1 | 9 | 5 | 11 | 28 |
| Ponderosa pine | 9 | 12 | 16 | 29 | 32 | 36 | 27 | 48 | 136 | 78 | 65 | 497 |
| Jeffrey pine | -- | 1 | 2 | 3 | 4 | 6 | 6 | 5 | 37 | 19 | 12 | 85 |
| Sugar pine | 2 | 2 | 2 | 5 | 5 | 4 | 6 | 6 | 26 | 27 | 45 | 130 |
| Lodgepole pine[2] | -- | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 2 | -- | 20 |
| Giant sequoia | -- | -- | -- | -- | -- | -- | -- | -- | 1 | 1 | 37 | 38 |
| Incense-cedar | 8 | 11 | 10 | 11 | 11 | 10 | 12 | 8 | 34 | 33 | 23 | 171 |
| Total softwoods[1] | 24 | 36 | 45 | 71 | 72 | 84 | 90 | 94 | 345 | 227 | 224 | 1,312 |
| Hardwoods: | | | | | | | | | | | | |
| White alder[3] | -- | 1 | 2 | 2 | 2 | 1 | 1 | 1 | -- | 1 | -- | 11 |
| Black oak | 2 | 4 | 6 | 7 | 8 | 8 | 11 | 5 | 27 | 12 | 3 | 92 |
| Other hardwoods[4] | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 1 | 5 | 2 | -- | 27 |
| Total hardwoods[1] | 4 | 8 | 9 | 12 | 13 | 12 | 15 | 7 | 32 | 15 | 3 | 130 |
| All species[1] | 29 | 44 | 54 | 83 | 85 | 97 | 104 | 101 | 377 | 242 | 227 | 1,441 |

[1] Totals may be off because of rounding.

[2] Includes 2 million cubic feet of western white pine and mountain hemlock.

[3] Includes bigleaf maple, cottonwood, and aspen.

[4] Includes canyon live oak, interior live oak, California white oak, and madrone.

Table 24--*Net volume of sawtimber on commercial forest land outside National Forests, by species and diameter class, San Joaquin resource area, California, January 1, 1973 (International 1/4-inch rule)*

(In million board feet)

| Species | Diameter class (inches at breast height) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 9.0-10.9 | 11.0-12.9 | 13.0-14.9 | 15.0-16.9 | 17.0-18.9 | 19.0-20.9 | 21.0-28.9 | 29.0-38.9 | 39.0 and larger | All classes[1] |
| Softwoods: | | | | | | | | | | |
| Douglas-fir | 16 | 23 | 31 | 32 | 41 | 21 | 102 | 36 | 171 | 473 |
| White fir | 37 | 77 | 63 | 132 | 133 | 141 | 667 | 420 | 119 | 1,789 |
| California red fir | 1 | 5 | 5 | 1 | -- | 6 | 51 | 32 | 73 | 174 |
| Ponderosa pine | 46 | 116 | 150 | 185 | 196 | 282 | 865 | 537 | 475 | 2,864 |
| Jeffrey pine | 5 | 11 | 20 | 32 | 30 | 27 | 163 | 128 | 89 | 506 |
| Sugar pine | 6 | 22 | 25 | 18 | 33 | 34 | 159 | 178 | 318 | 793 |
| Lodgepole pine[2] | 8 | 7 | 9 | 10 | 9 | 13 | 25 | 13 | 1 | 95 |
| Giant sequoia | -- | -- | -- | -- | -- | -- | 2 | 3 | 192 | 196 |
| Incense-cedar | 40 | 48 | 51 | 49 | 63 | 41 | 190 | 195 | 139 | 816 |
| Total softwoods[1] | 158 | 309 | 355 | 460 | 517 | 564 | 2,224 | 1,543 | 1,576 | 7,707 |
| Hardwoods: | | | | | | | | | | |
| White alder[3] | -- | 4 | 6 | 5 | 3 | 4 | 2 | 4 | -- | 28 |
| Black oak | -- | 13 | 16 | 19 | 28 | 14 | 84 | 45 | 14 | 234 |
| Other hardwoods[4] | -- | 7 | 6 | 7 | 8 | 4 | 14 | 8 | 1 | 55 |
| Total hardwoods[1] | -- | 24 | 29 | 31 | 38 | 22 | 99 | 58 | 16 | 317 |
| All species[1] | 158 | 333 | 384 | 491 | 556 | 586 | 2,323 | 1,601 | 1,592 | 8,024 |

[1] Totals may be off because of rounding.

[2] Includes 4 million board feet of western white pine and 2 million board feet of mountain hemlock.

[3] Includes bigleaf maple and cottonwood.

[4] Includes canyon live oak, California white oak, and madrone.

Table 25--*Net volume of sawtimber on commercial forest land outside National Forests, by species and diameter class, San Joaquin resource area, California, January 1, 1973 (Scribner rule)*

(In million board feet)

| Species | Diameter class (inches at breast height) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 9.0-10.9 | 11.0-12.9 | 13.0-14.9 | 15.0-16.9 | 17.0-18.9 | 19.0-20.9 | 21.0-28.9 | 29.0-38.9 | 39.0 and larger | All classes[1] |
| Softwoods: | | | | | | | | | | |
| Douglas-fir | -- | 18 | 23 | 25 | 33 | 17 | 89 | 33 | 107 | 345 |
| White fir | -- | 57 | 49 | 105 | 108 | 118 | 577 | 380 | 113 | 1,506 |
| California red fir | -- | 2 | 4 | 1 | -- | 5 | 45 | 29 | 69 | 154 |
| Ponderosa pine | -- | 60 | 105 | 145 | 174 | 244 | 781 | 499 | 444 | 2,453 |
| Jeffrey pine | -- | 3 | 11 | 22 | 23 | 22 | 144 | 120 | 85 | 429 |
| Sugar pine | -- | 12 | 18 | 14 | 26 | 29 | 138 | 163 | 301 | 701 |
| Lodgepole pine[2] | -- | 5 | 7 | 9 | 8 | 10 | 22 | 12 | 1 | 74 |
| Giant sequoia | -- | -- | -- | -- | -- | -- | 2 | 2 | 187 | 192 |
| Incense-cedar | -- | 28 | 34 | 35 | 48 | 33 | 159 | 173 | 122 | 631 |
| Total softwoods[1] | -- | 184 | 251 | 356 | 420 | 478 | 1,957 | 1,410 | 1,429 | 6,485 |
| Hardwoods: | | | | | | | | | | |
| White alder[3] | -- | 4 | 6 | 5 | 3 | 4 | 1 | 4 | 1 | 28 |
| Black oak | -- | 12 | 16 | 19 | 28 | 14 | 83 | 45 | 14 | 230 |
| Other hardwoods[4] | -- | 7 | 6 | 6 | 8 | 4 | 14 | 8 | 1 | 53 |
| Total hardwoods[1] | -- | 23 | 28 | 30 | 38 | 21 | 98 | 57 | 16 | 311 |
| All species[1] | -- | 207 | 279 | 386 | 458 | 499 | 2,055 | 1,467 | 1,445 | 6,796 |

[1] Totals may be off because of rounding.

[2] Includes 2 million board feet of western white pine and 1 million board feet of mountain hemlock.

[3] Includes bigleaf maple and cottonwood.

[4] Includes canyon live oak, California white oak, and madrone.

Table 26--*Volume of timber on commercial forest land outside National Forests, by class of timber and by softwoods and hardwoods, San Joaquin resource area, California, January 1, 1973*

(In million cubic feet)

| Class of timber | Softwoods | Hardwoods | All species |
|---|---|---|---|
| Sawtimber trees: | | | |
| Saw-log portion | 1,206 | 57 | 1,263 |
| Upper-stem portion | 45 | 51 | 96 |
| Total | 1,251 | 108 | 1,359 |
| Poletimber trees | 60 | 21 | 81 |
| All growing-stock trees | 1,311 | 129 | 1,440 |
| Sound cull trees | 7 | 22 | 29 |
| Rotten cull trees | 1 | 14 | 15 |
| Salvable dead trees | 20 | [1] | 20 |
| All timber | 1,339 | 165 | 1,504 |

[1] Less than 500,000 cubic feet.

Table 27--*Number of growing-stock trees on commercial forest land outside National Forests, by species and diameter class, San Joaquin resource area, California, January 1, 1973*

(In thousand trees)

| Species | Diameter class (inches at breast height) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0-2.9 | 3.0-4.9 | 5.0-6.9 | 7.0-8.9 | 9.0-10.9 | 11.0-12.9 | 13.0-14.9 | 15.0-16.9 | 17.0-18.9 | 19.0-20.9 | 21.0-28.9 | 29.0-38.9 | 39.0 and larger | All classes[1] |
| Softwoods: | | | | | | | | | | | | | | |
| Douglas-fir | 1,325 | 640 | 733 | 211 | 281 | 167 | 160 | 109 | 105 | 36 | 131 | 22 | 15 | 3,935 |
| White fir | 7,061 | 4,390 | 1,989 | 1,719 | 1,223 | 1,180 | 536 | 672 | 475 | 357 | 873 | 277 | 37 | 20,789 |
| California red fir | 735 | 160 | -- | 75 | 35 | 75 | 48 | 9 | -- | 21 | 74 | 23 | 15 | 1,270 |
| Ponderosa pine | 6,940 | 3,398 | 4,020 | 2,532 | 1,751 | 1,720 | 1,189 | 917 | 672 | 638 | 1,095 | 273 | 100 | 25,246 |
| *Jeffrey pine* | 218 | 143 | 133 | 235 | 302 | 254 | 246 | 239 | 173 | 95 | 321 | 92 | 22 | 2,474 |
| Sugar pine | 2,192 | 1,696 | 970 | 501 | 219 | 342 | 205 | 100 | 120 | 91 | 230 | 108 | 63 | 6,837 |
| Western white pine | 32 | 16 | -- | 18 | 32 | 16 | 6 | 5 | 3 | 5 | -- | -- | -- | 134 |
| Lodgepole pine | 107 | 164 | 91 | 135 | 185 | 97 | 98 | 65 | 46 | 29 | 45 | 12 | -- | 1,076 |
| Mountain hemlock | -- | -- | -- | 20 | 27 | 8 | -- | -- | -- | 3 | -- | -- | -- | 58 |
| *Giant sequoia* | -- | 73 | -- | -- | 32 | -- | -- | -- | -- | -- | 7 | 4 | 9 | 125 |
| Incense-cedar | 21,466 | 9,277 | 4,576 | 2,904 | 1,390 | 1,029 | 637 | 433 | 338 | 189 | 487 | 237 | 85 | 43,048 |
| Total softwoods[1] | 40,078 | 19,957 | 12,512 | 8,351 | 5,476 | 4,887 | 3,126 | 2,550 | 1,933 | 1,463 | 3,263 | 1,048 | 346 | 104,992 |
| Hardwoods: | | | | | | | | | | | | | | |
| White alder[2] | 859 | 282 | 222 | 162 | 161 | 107 | 88 | 42 | 21 | 18 | 3 | 4 | -- | 1,968 |
| Black oak | 1,818 | 1,611 | 947 | 1,066 | 761 | 572 | 426 | 323 | 338 | 120 | 396 | 95 | 11 | 8,485 |
| Other hardwoods[3] | 7,122 | 3,192 | 740 | 674 | 245 | 299 | 162 | 118 | 86 | 29 | 73 | 20 | 2 | 12,762 |
| Total hardwoods[1] | 9,800 | 5,085 | 1,909 | 1,902 | 1,167 | 978 | 676 | 483 | 445 | 167 | 472 | 119 | 13 | 23,215 |
| All species[1] | 49,878 | 25,042 | 14,241 | 10,253 | 6,643 | 5,865 | 3,802 | 3,033 | 2,378 | 1,630 | 3,735 | 1,167 | 359 | 128,205 |

[1] Totals may be off because of rounding.

[2] Includes bigleaf maple, cottonwood, and aspen.

[3] Includes canyon live oak, interior live oak, California white oak, and madrone.

Table 28--*Net annual growth of growing stock on commercial forest land, by ownership class, San Joaquin resource area, California, 1972*

| Ownership | Growth per acre | Growing stock | | |
|---|---|---|---|---|
| | | Softwoods | Hardwoods | All species |
| | Cubic feet | - - - - Thousand cubic feet - - - - | | |
| National Forests | 41.7 | 72,100 | 200 | 72,300 |
| Other public | 40.1 | 1,518 | 208 | 1,726 |
| Private | 58.1 | 25,641 | 1,556 | 27,197 |
| All ownerships | 45.1 | 99,259 | 1,964 | 101,223 |

Table 29--*Net annual growth of growing stock and sawtimber on commercial forest land outside National Forests by species, San Joaquin resource area, California, January 1, 1973*

| Species | Growing stock | Sawtimber | |
|---|---|---|---|
| | | International 1/4-inch rule | Scribner rule |
| | Thousand cubic feet | - - - - - Thousand board feet - - - - - | |
| Softwoods: | | | |
| Douglas-fir[1] | 1,152 | 7,535 | 9,312 |
| White fir[1] | 5,015 | 37,013 | 42,613 |
| California red fir | 123 | 699 | 588 |
| Ponderosa pine | 12,549 | 78,789 | 69,437 |
| Jeffrey pine | 1,522 | 9,701 | 8,872 |
| Sugar pine | 3,658 | 22,128 | 20,151 |
| Lodgepole pine[2] | 364 | 2,120 | 1,448 |
| Giant sequoia | 248 | 1,202 | 1,188 |
| Incense-cedar | 2,528 | 11,538 | 9,672 |
| Total softwoods[3] | 27,159 | 170,726 | 163,280 |
| Hardwoods: | | | |
| White alder[4] | 177 | 825 | 816 |
| Black oak | 1,069 | 3,058 | 3,024 |
| Other hardwoods[5] | 518 | 808 | 796 |
| Total hardwoods[3] | 1,764 | 4,691 | 4,635 |
| All species[3] | 28,923 | 175,418 | 167,915 |

[1] Net annual growth in International 1/4-inch board feet is less than Scribner for these species because of relatively high mortality in trees 9.0 to 10.9 inches in size.

[2] Includes western white pine and mountain hemlock.

[3] Totals may be off because of rounding.

[4] Includes bigleaf maple, cottonwood, and aspen.

[5] Includes canyon live oak, interior live oak, California white oak, and madrone.

Table 30--*Net annual growth of growing stock and sawtimber on commercial forest land outside National Forests, by forest types, San Joaquin resource area, California, January 1, 1973*

| Forest type | Growing stock | Sawtimber | |
|---|---|---|---|
| | | International 1/4-inch rule | Scribner rule |
| | Thousand cubic feet | Thousand board feet | |
| Douglas-fir | 474 | 4,277 | 6,924 |
| White fir | 4,907 | 30,293 | 37,370 |
| California red fir | 43 | 256 | 223 |
| Ponderosa pine | 12,122 | 72,352 | 61,236 |
| Jeffrey pine | 1,609 | 10,358 | 9,453 |
| Sugar pine | 1,132 | 8,717 | 6,792 |
| Lodgepole pine | 295 | 1,596 | 1,095 |
| Giant sequoia | 156 | 677 | 673 |
| Incense-cedar | 5,290 | 31,415 | 27,367 |
| California black oak | 1,104 | 6,302 | 5,971 |
| California white oak | 444 | 2,368 | 2,213 |
| Madrone | 71 | 106 | 104 |
| Other hardwoods | 1,273 | 6,684 | 8,474 |
| Nonstocked | 5 | 19 | 19 |
| All types[1] | 28,923 | 175,418 | 167,915 |

[1] Totals may be off because of rounding.

Table 31--*Average annual mortality of growing stock and sawtimber on commercial forest land outside National Forests, by species, San Joaquin resource area, California*

| Species | Growing stock | Sawtimber | |
|---|---|---|---|
| | | International 1/4-inch rule | Scribner rule |
| | Thousand cubic feet | Thousand board feet | |
| Softwoods: | | | |
| Douglas-fir | 106 | 374 | -- |
| White fir | 2,034 | 12,044 | 9,469 |
| California red fir | 165 | 1,048 | 946 |
| Ponderosa pine | 1,842 | 9,486 | 7,710 |
| Jeffrey pine | 234 | 1,706 | 1,599 |
| Sugar pine | 105 | 143 | 75 |
| Lodgepole pine | 28 | 191 | 172 |
| Incense-cedar | 1,344 | 7,511 | 5,828 |
| Total | 5,859 | 32,504 | 25,799 |
| All hardwoods | 70 | 78 | 76 |
| All species[1] | 5,929 | 32,582 | 25,875 |

[1] Totals may be off because of rounding.

*Table 32--Reported timber production by county, San Joaquin resource area, and all of California, 1947-75*

(In thousand board feet)[1]

| Year | Alpine | Amador | Calaveras | Fresno | Kern | Kings[2] | Madera | Merced | Mariposa | Mono | Tulare | Toulumne | Resource area total[3] | All of California |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1947 | 640 | 57,893 | 149,987 | 37,253 | 1,930 | | 21,373 | [2] | 17,828 | 7,602 | 52,216 | 152,973 | 499,695 | 3,185,995 |
| 1948 | 495 | 14,826 | 155,884 | 40,755 | 600 | | 18,628 | [2] | 22,386 | 6,290 | 64,657 | 164,840 | 489,361 | 3,983,213 |
| 1949 | 765 | 8,961 | 139,218 | 42,865 | 2,950 | | 10,288 | [2] | 18,370 | 14,586 | 46,918 | 142,976 | 427,897 | 3,795,252 |
| 1950 | [4] | 16,409 | 185,819 | 42,852 | 4,800 | | 40,451 | [2] | 5,185 | 14,144 | 98,604 | 162,689 | 571,043 | 4,303,011 |
| 1951 | [4] | 42,114 | 155,584 | 32,011 | 1,650 | | 38,967 | [2] | 16,736 | 800 | 57,545 | 173,824 | 519,231 | 4,984,288 |
| 1952 | 6,784 | 22,805 | 108,157 | 62,761 | 2,120 | | 39,208 | [2] | 12,068 | 15,250 | 53,428 | 143,626 | 466,207 | 5,057,036 |
| 1953 | 9,925 | 16,161 | 150,262 | 66,893 | [5] | | 41,861 | [2] | 14,830 | 14,798 | [5]41,792 | 164,829 | 521,351 | 5,990,088 |
| 1954 | [4] | 23,474 | 128,195 | 64,976 | [5] | | 26,095 | [2] | 15,055 | [4]22,563 | [5]35,414 | 117,075 | 432,847 | 5,600,310 |
| 1955 | [4] | 34,275 | 112,977 | 67,606 | [5] | | 56,153 | [6] | [6]8,519 | [4]7,536 | [5]54,560 | 155,128 | 496,754 | 6,014,939 |
| 1956 | [4] | 35,552 | 125,183 | 86,304 | [5] | | 72,768 | [6] | [6]13,725 | [4]23,055 | [5]48,740 | 132,135 | 537,462 | 5,861,634 |
| 1957 | [4] | 34,759 | 107,589 | 58,768 | [5] | | 45,424 | [6] | [6]14,101 | [4]43,589 | [5]28,416 | 148,032 | 480,678 | 5,346,521 |
| 1958 | [4] | 39,088 | 98,925 | 68,326 | [5] | | 61,964 | [6] | [6]5,558 | [4]28,024 | [5]39,041 | 114,203 | 455,129 | 5,675,392 |
| 1959 | [4] | 12,680 | 116,249 | 60,166 | [5] | | 74,746 | [6] | [6]15,254 | [4]27,967 | [5]51,821 | 134,856 | 493,739 | 5,886,061 |
| 1960 | [4] | 16,178 | 74,188 | 52,534 | [5] | | 64,020 | [6] | [6]18,593 | [4]16,676 | [5]39,968 | 74,186 | 356,343 | 5,136,649 |
| 1961 | [4] | 60,668 | 105,790 | 40,765 | [5] | | 61,436 | [6] | [6]1,378 | [4]13,300 | [5]42,680 | 133,755 | 459,772 | 5,342,250 |
| 1962 | [4] | 43,786 | 73,563 | 74,989 | [5] | | 59,724 | [6] | [6]6,504 | [4]11,607 | [5]63,707 | 26,988 | 360,868 | 5,538,928 |
| 1963 | [4] | 21,681 | 97,600 | 48,660 | [5] | | 55,683 | [6] | [6]4,481 | [4]25,210 | [5]84,965 | 122,801 | 461,081 | 5,461,046 |
| 1964 | [4] | 36,076 | 54,627 | 74,017 | [5] | | 62,630 | [6] | [6]19,853 | [4]8,098 | [5]88,000 | 110,146 | 453,447 | 5,476,265 |
| 1965 | [4] | 40,814 | 75,099 | 76,251 | [5] | | 52,982 | [6] | [6]8,406 | [4]4,202 | [5]69,955 | 145,595 | 473,304 | 5,271,234 |
| 1966 | [4] | 11,462 | 50,581 | 87,980 | [5] | | 70,312 | [6] | [6]10,506 | [4]4,019 | [5]70,922 | 191,725 | 497,507 | 5,008,318 |
| 1967 | [4] | 35,203 | 60,162 | 84,011 | [5] | | 68,589 | [6] | [6]8,745 | [4]3,004 | [5]83,013 | 178,816 | 521,543 | 5,062,021 |
| 1968 | [4] | 25,405 | 85,137 | 104,256 | [5] | | 60,898 | [6] | [6]1,188 | [4]15,630 | [5]98,025 | 189,012 | 579,551 | 5,343,898 |
| 1969 | [4] | 26,856 | 45,020 | 137,242 | [5] | | 63,923 | [6] | [6]17,283 | [4]11,857 | [5]89,616 | 157,795 | 549,556 | 5,000,596 |
| 1970 | [4] | 12,849 | 72,016 | 109,840 | [5] | | 77,043 | [6] | [6]11,004 | [4]9,210 | [5]79,192 | 153,861 | 525,015 | 4,565,827 |
| 1971 | [4] | 29,891 | 55,731 | 86,944 | [5] | | 74,545 | [6] | [6]10,578 | [4]8,034 | [5]149,823 | 160,168 | 575,714 | 4,789,617 |
| 1972 | [4] | 38,893 | 47,767 | 88,520 | [5] | | 82,009 | [6] | [6]7,782 | [4]25,284 | [5]155,211 | 150,666 | 596,132 | 5,000,507 |
| 1973 | [4] | 36,761 | 51,743 | 99,831 | [5] | | 69,598 | [6] | [6]8,757 | [4]14,819 | [5]123,247 | 145,190 | 549,946 | 4,923,000 |
| 1974 | [4] | 35,043 | 21,071 | 121,284 | [5] | | 58,882 | [6] | [6]1,606 | [4]5,620 | [5]77,637 | 165,966 | 487,109 | 4,703,614 |
| 1975 | [4] | 40,232 | 35,977 | 136,304 | [5] | | 64,289 | [6] | [6]15,977 | [4]2,212 | [5]82,657 | 120,722 | 498,370 | 4,334,423 |

[1] Source: "Production of California Timber Operators," State Forest Notes published annually by California Division of Forestry Various log rules are used in California; no attempt was made to convert the data to a common base; however, the majority of the timber industry companies in the San Joaquin resource area used the short-log Scribner rule.

[2] No reported production (county mostly nonforest).

[3] San Joaquin and Stanislau counties are mostly nonforest. No timber production was reported from these counties.

[4] Alpine, Mono, and Inyo were combined.

[5] Kern, Tulare, and Ventura were combined.

[6] Mariposa and Merced were combined.

Table 33--*Confidence intervals for the estimates of forest area and timber volume outside National Forests, San Joaquin resource area, California, January 1, 1973*

| Item | Estimated total | Confidence interval | |
|---|---|---|---|
| | | 68-percent probability | 95-percent probability |
| | | - - - - Percent - - - - | |
| Commercial forest land | 512,000 acres | ±3.7 | ±7.2 |
| Noncommercial forest land | 2,424,000 acres[1] | ±1.8 | ±3.5 |
| Volume: | | | |
| Growing stock | 1,441 million cubic feet | ±5.8 | ±11.4 |
| Sawtimber (International 1/4-inch rule) | 8,024 million board feet | ±6.8 | ±13.3 |

[1] Includes only the forest area outside parks and other reservations, determined by sampling methods. Forest area within parks and other reservations was determined by type-mapping procedures not subject to sampling error.

Table 34--*Approximate confidence interval by size of estimate, outside National Forests, San Joaquin resource area, California, January 1, 1973*

| Commercial forest land | | Noncommercial forest land | | Growing stock | | Sawtimber | |
|---|---|---|---|---|---|---|---|
| Area | Confidence interval[1] (+ or -) | Area | Confidence interval[1] (+ or -) | Volume | Confidence interval[1] (+ or -) | Volume | Confidence interval[1] (+ or -) |
| Thousand acres | Percent | Thousand acres | Percent | Million cubic feet | Percent | Million board feet[2] | Percent |
| 512 | 3.7 | 2,424 | 1.8 | 1,441 | 5.8 | 8,024 | 6.8 |
| 250 | 5.3 | 1,500 | 2.3 | 750 | 8.0 | 6,000 | 7.8 |
| 125 | 7.5 | 1,000 | 2.8 | 500 | 9.8 | 4,000 | 9.6 |
| 100 | 8.3 | 500 | 4.0 | 250 | 13.8 | 2,000 | 13.5 |
| 75 | 9.6 | 250 | 5.7 | 225 | 14.6 | 1,000 | 19.2 |
| 50 | 11.8 | 125 | 8.0 | 175 | 16.5 | 750 | 22.1 |
| 25 | 16.7 | 100 | 9.0 | 150 | 17.9 | 500 | 27.1 |
| 10 | 26.4 | 75 | 10.3 | 125 | 19.6 | 250 | 38.3 |
| 5 | 37.3 | 50 | 12.7 | 100 | 21.9 | 225 | 40.4 |
| | | 25 | 17.9 | 75 | 25.3 | 200 | 42.8 |
| | | 10 | 20.3 | 50 | 31.0 | 175 | 49.4 |
| | | 5 | 40.1 | 25 | 43.8 | 150 | 49.4 |
| | | | | 10 | 69.3 | 125 | 54.2 |
| | | | | | | 100 | 60.6 |
| | | | | | | 75 | 69.9 |
| | | | | | | 50 | 85.6 |
| | | | | | | 25 | 121.1 |
| | | | | | | 10 | 191.5 |

[1] By random sampling formula: 68-percent probability.

[2] International 1/4-inch rule.

# REFERENCES

Barrette, B. R., D. R. Gedney, and D. D. Oswald.
1970. California timber industries, 1968, mill characteristics and wood supply. Calif. Dep. Conserv. Div. For. 117 p. Sacramento, Calif.

Burks, George F., H. J. Vaux, R. H. May, and A. Simontacchi.
1948. Commodity production from commercial forest land in California, 1946. USDA For. Serv. Calif. For. and Range Exp. Stn. For. Surv. Release 6, 38 p. Berkeley, Calif.

California Department of Fish and Game.
1966. California fish and wildlife plan. 5 vols. Sacramento, Calif.

California Department of Water Resources.
1972. Dams within jurisdiction of the State of California. Dep. Water Resour. Bull 17-71, 66 p. Sacramento, Calif.

California Department of Water Resources.
1974. The California water plan, outlook in 1974. Bull. No. 160-74, 186 p. Sacramento, Calif.

California Division of Forestry.
1947-75. Production of California timber operators. State For. Notes. (Annu. publ.) Sacramento, Calif.

California Division of Forestry.
1953-74. California wildfire statistics - annual reports. Sacramento, Calif.

California Division of Forestry.
1961-74. Brushland range improvement annual reports. Sacramento, Calif.

California Division of Forestry.
1968. California forest practices rules - California administrative code, title 14, div. 2, ch. 2. Sacramento, Calif.

California Division of Forestry.
1969. Soil-vegetation surveys in California. State coop. Calif. Div. For., USDA For. Serv. Pac. Southwest For. and Range Exp. Stn., Univ. Calif., Agric. Exp. Stn., Sacramento, Calif.

Dahms, Walter G.
1964. Gross and net yield tables for lodgepole pine. USDA For. Serv. Res. Pap. PNW-8, 14 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Dunning, Duncan, and L. H. Reineke.
1933. Preliminary yield tables for second-growth stands in the California pine region. U.S. Dep. Agric. Tech. Bull. No. 354, 23 p. Washington, D.C.

Fowells, H. A., and N. B. Stark.
1965. Natural regeneration in relation to environment in the mixed conifer type of California. USDA For. Serv. Res. Pap. PSW-24. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

Griffin, James R.
1967. Soil moisture and vegetation patterns in northern California forests. USDA For. Serv. Res. Pap. PSW-46, 22 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

Griffin, James R., and William B. Critchfield.
1972. The distribution of forest trees in California. USDA For. Serv. Res. Pap. PSW-82, 114 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

Howard, James O.
1974. California forest industry--wood consumption characteristics, 1972. USDA For. Serv. Resour. Bull. PNW-52, 91 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Little, Elbert L., Jr.
1953. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric. Agric. Handb. 41, 472 p.

McArdle, Richard E., W. H. Meyer, and D. Bruce.
1961. The yield of Douglas-fir in the Pacific Northwest. U.S. Dep. Agric. Tech. Bull. 201 (rev.), 74 p., illus.

McDonald, Philip M.
1973. Cutting a young-growth mixed-conifer stand to California Forest Practice Act standards. USDA For. Serv. Res. Pap. PSW-89, 16 p. Berkeley, Calif.

MacLean, Colin D., and Charles L. Bolsinger.
1973a. Estimating Dunning's site index from plant indicators. USDA For. Serv. Res. Note PNW-197, 10 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

MacLean, Colin D., and Charles L. Bolsinger.
1973b. Estimating productivity on sites with a low stocking capacity. USDA For. Serv. Res. Pap. PNW-152, 18 p. Pac. Northwest For. Range Exp. Stn., Portland, Oreg.

MacLean, Colin D., and Charles L. Bolsinger.
1974. Stockability equations for California forest land. USDA For. Serv. Res. Note PNW-233, 10 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

May, Richard H., and Harold Baker.
1958. Output of timber products in California, 1956. USDA For. Serv. Calif. For. and Range Exp. Stn. For. Surv. Release 35, 35 p. Berkeley, Calif.

Meyer, Walter H.
1961. Yield of even-aged stands of ponderosa pine. U.S. Dep. Agric. Tech. Bull. 630, 59 p.

Muerle, G. F., and E. M. Hornibrook.
1965. Timber harvest in California, 1962. USDA For. Serv. Resour. Bull. PSW-2, 29 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

Munz, Philip A., and David D. Keck.
1970. A California flora. 1,681 p. Univ. Calif. Press, Berkeley.

Oswald, Daniel D.
1970. California forest industries--prospects for the future. USDA For. Serv. Resour. Bull. PNW-35, 55 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Oswald, Daniel D., and E. M. Hornibrook.
1966. Commercial forest area and timber volume in California, 1963. USDA For. Serv. Resour. Bull. PSW-4, 16 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

Schumacher, Francis X.
1926. Yield, stand and volume tables for white fir in the California pine region. Calif. Agric. Exp. Stn. Bull. No. 407, 26 p., illus. Univ. Calif., Berkeley.

Schumacher, Francis X.
1930. Yield, stand and volume tables for Douglas-fir in California. Calif. Agric. Exp. Stn. Bull. No. 491, 41 p., illus. Univ. Calif., Berkeley.

State of California.
1974. California administrative code, title 14, div. 2, ch. 2; art. 4, div. 4, ch. 8. Public Resour. Code.

State of California.
1976. Assembly bill No. 1258. Sacramento, Calif.

State of California, Documents Section.
1975. California statistical abstract. 146 p. Sacramento, Calif.

U.S. Department of Agriculture, Forest Service.
1953-73. Timber cut and sold on National Forests - report 1380 (2400). Reg. 4, Ogden, Utah; Reg. 5, San Francisco, Calif.

U.S. Department of Agriculture, Forest Service.
1954. Forest statistics for California. USDA For. Serv. Calif. For. and Range Exp. Stn. For. Surv. Release 25, 66 p. Berkeley, Calif.

U.S. Department of Agriculture, Forest Service.
1965. Silvics of forest trees of the United States. U.S. Dep. Agric. Agric. Handb. No. 271, 762 p. Washington, D.C.

U.S. Department of Agriculture, Forest Service.
1972. Forest Service manual, title 2400 - Timber management - section 2412 Land classification. Washington, D.C.

U.S. Department of Agriculture, Forest Service.
1976. Land use classification, timber land use summary and annual potential yield statement, reports 24.21, 24.21A, 24.21B, 24.21C, and 24.22A, Region 5. San Francisco, Calif.

U.S. Office of Management and Budget.
1972. Standard industrial classification manual, 1972. 649 p.

Waring, R. H., K. L. Reed, and W. H. Emmingham.
1972. An environmental grid for classifying coniferous forest ecosystems. *In* Proceedings--Research on coniferous forest ecosystems--a symposium. Jerry F. Franklin et al., eds. p. 79-91, illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Wieslander, A. E., and Herbert A. Jensen.
1946. Forest areas, timber volumes and vegetation types in California. USDA For. Serv. Calif. For. and Range Exp. Stn. For. Surv. Release 4, 66 p. Berkeley.

# APPENDIX

## RELIABILITY OF FOREST RESOURCE ESTIMATES

The estimates of forest land area and timber volume outside National Forests in the San Joaquin resource area were derived by sampling and thus have sampling error. Confidence intervals have been computed for the estimate of commercial forest land area, noncommercial forest land area, net cubic-foot volume of growing stock, and net board-foot volume (International 1/4-inch rule) of sawtimber. These confidence intervals are presented in table 33 as a percent of the estimated total at the 68-percent and 95-percent probability levels. They may be interpreted as meaning that the odds are two out of three for 68-percent probability, or 19 out of 20 for 95-percent probability that the ranges shown include the true value (i.e., the results of a 100-percent inventory). For example, we can expect, with 95-percent confidence, that the estimate of commercial forest land area--512,000 acres ± 7.2 percent (36,864 acres)--includes the true value.

In addition to measurable sampling errors, there may be nonsampling errors caused by mistakes in judgment, measurement, and compilation. The magnitude of errors of this nature cannot be determined; however, such errors are kept to a minimum through training, supervision, field checking, editing, and machine verification when the data are compiled.

The reliability of any breakdown of these totals will be substantially less than the sampling error of the total. The smaller the breakdown the larger the confidence interval. An approximation of confidence intervals associated with various breakdown of the totals can be obtained from table 34.

## INVENTORY PROCEDURES

The forest statistics for lands outside National Forests were collected in 1972 by Renewable Resources Evaluation personnel of the Pacific Northwest Forest and Range Experiment Station. The procedures used for these lands were designed specifically so that the kinds of data shown in this report could be obtained. The forest statistics for the Toiyabe National Forest of Region 4 were collected in 1975 by Region 4 and Toiyabe National Forest personnel using procedures nearly identical to the ones we used on lands outside National Forests.

For *lands outside National Forests* and for the *Toiyabe National Forest*, a double sampling inventory design was used. Aerial photo sample plots 1 acre in size were distributed systematically across the area and classified into commercial forest, noncommercial forest, and nonforest. Commercial forest plots were further classified into several stand volume classes. In addition, plots outside National Forests were classified by owner from county tax assessor records. A random sample of field plots was selected, proportional to the number of aerial photo plots in each land class, volume class, and ownership class on lands outside National Forests. The field sample was used to adjust the aerial photo sample for photo interpretation errors and changes since the date of photography. It also provided detailed stand data such as stocking by species, volume by size class, etc. Field plots consisted of 10 sample points distributed over an acre. The variable radius plot sampling principle was used to select trees 5.0 inches and larger in d.b.h. to be tallied; trees smaller than 5 inches were tallied on a circular fixed radius plot. Where no trees were tallied, a ground cover class was recorded. Also recorded were indicator plants and other physical variables used to predict stockability and site index where suitable site trees were not present (MacLean and Bolsinger 1973a). Information on past disturbance or treatment and nontimber uses was also recorded. Increment borings were taken from all trees 5.0 inches and larger on 3 of the 10 points for determining the past 10 years' growth. Mortality was estimated over a 5-year period by postdating all dead trees tallied.

The sample on lands outside National Forests consisted of 13,953 aerial photo plots in all land classes, from which were selected 220 commercial forest field plots and 509 noncommercial forest field plots.

The Toiyabe National Forest sample within the San Joaquin resource area consisted of 2,026 aerial photo plots in all land classes, from which were selected 131 commercial forest field plots and 59 noncommercial forest field plots.

Timber inventories for *Region 5 National Forests* were designed specifically to provide data for their timber planning model. They provide statistics on total area, volume, growth, and mortality for entire National Forests but do not provide details for counties within the San Joaquin resource area.

For Region 5, National Forests type maps were made on which commercial, noncommercial, and nonforest land classes were delineated. Commercial forest areas were then further divided into condition classes and major types. Type-mapped areas of noncommercial and nonforest land were accepted without ground checking. For sampling commercial forest area, field plots were distributed proportional to area by condition class and major type. Field plots consisted of five sample points 132 feet apart in an L-shape. At each point the variable radius plot sampling principle was used to select tally trees 1-inch d.b.h. and larger. Trees smaller than 1-inch d.b.h. were tallied on a circular, fixed radius plot. Growth and mortality estimates were developed from 10-year increment borings and 5-year post-dating of dead trees.

The following tabulation shows the total number of plots established on these National Forests and the approximate proportion of commercial forest area within the San Joaquin resource area:

| National Forest | Number of plots | Proportion of commercial forest in San Joaquin resource area | Inventory date |
|---|---|---|---|
| Eldorado | 102 | 0.10 | 1974 |
| Inyo | 60 | .94 | [1] 1964 |
| Los Padres | 72 | .17 | 1975 |
| Sequoia | 141 | 1.00 | [1] 1958 |
| Sierra | 97 | 1.00 | 1975 |
| Stanislaus | 118 | 1.00 | 1972 |
|  | 590 | .82 |  |

DEFINITION OF TERMS

## Land Area

*Total land area* is that reported by the Bureau of the Census and includes dry land and land temporarily or partially covered by water (such as marshes, swamps, and river flood plains), streams, sloughs, and canals less than 1/8-mile wide, and lakes, reservoirs, and ponds less than 40 acres in size.

*Forest land* is at least 10 percent stocked by trees of any size or is land that formerly had such tree cover and is not currently developed for nonforest use. Minimum area of forest land recognized is 1 acre.

*Nonforest land* has never supported forests or was formerly forested and is currently developed for nonforest uses. Included are lands used for agricultural crops, improved pasture, residential areas, city parks, improved roads of any width and their right-of-way clearings, and powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and other nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as nonforest land.

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[1] Recent inventories of these National Forests have not yet been compiled. Statistics shown in this report for these National Forests have been adjusted to account for major changes since the inventory dates shown.

## Forest Land Classes

*Commercial forest land* is capable of producing 20 cubic feet per acre per year of industrial wood and is not withdrawn from timber utilization.

*Noncommercial forest land* consists of unproductive forest land and productive reserved forest land.

*Productive reserved forest land* is withdrawn from timber utilization through statute, ordinance, or administrative order but otherwise qualifies as commercial forest land.

*Unproductive forest land* is incapable of yielding crops of industrial wood products because of adverse site conditions such as sterile soil, poor drainage, high elevation, steepness, and rockiness.

## Forest Types

Forest types are determined on the basis of species plurality of all live trees that contribute to stocking; both size and spacing are considered.

## Tree Classes

### *Growing Stock*

Sawtimber trees, poletimber trees, saplings, and seedlings are included; that is, all live trees except cull trees.

*Sawtimber trees* are growing-stock trees and are at least 9.0 inches in d.b.h. if they are softwoods, and at least 11.0 inches in d.b.h. if they are hardwoods. At least 25 percent of the board-foot volume in any sawtimber tree must be free from defect. Softwood trees must contain at least one 12-foot saw log with a top diameter of not less than 6 inches inside the bark. Hardwood trees must contain at least one 8-foot saw log with a top diameter of not less than 8 inches inside the bark.

*Poletimber trees* are 5.0- to 8.9-inch d.b.h., live, and of commercial species, not less than 25 percent sound on a cubic-foot basis, and have no disease, defects, or deformities likely to prevent them from becoming growing-stock sawtimber trees.

*Sapling and seedling trees* are less than 5.0-inch d.b.h., live, of commercial species, and have no disease, defects, or deformities likely to prevent them from becoming growing-stock poletimber trees.

*Nongrowing Stock*

*Cull trees* are noncommercial species or commercial species which are too defective or are unlikely to become growing-stock trees because of deformity, disease, low vigor, etc.

*Sound cull trees* are noncommercial species or commercial species with excessive defect because of form, roughness, etc.

*Rotten cull trees* have excessive defect, primarily from rot.

*Mortality trees* are commercial species which have died from natural causes within a specified period and which were not cull trees at the time of death.

*Salvable dead trees* are standing or down trees of commercial species, 11.0 inches or more in diameter; they contain 25 percent or more of sound volume and at least one merchantable 16-foot log for softwoods or one merchantable 8-foot log for hardwoods.

## Stand Size Classes

*Sawtimber stands* are at least 10.0 percent stocked with growing-stock trees; half or more of this stocking is in sawtimber and poletimber trees and sawtimber stocking is equal to or greater than poletimber stocking. In *large sawtimber stands*, the majority of the sawtimber stocking is in trees 21.0 inches and larger at breast height. In *small sawtimber stands*, the majority of the sawtimber stocking is in softwood trees from 9.0- to 20.9-inch d.b.h. and hardwood trees 11.0- to 20.9-inch d.b.h.

*Poletimber stands* are at least 10.0 percent stocked with growing-stock trees; half or more of this stocking is in sawtimber and poletimber trees, and poletimber stocking exceeds sawtimber stocking.

*Sapling and seedling stands* are at least 10.0 percent stocked with growing-stock trees; more than half of this stocking is in saplings and seedlings.

*Nonstocked areas* of commercial forest land are less than 10.0 percent stocked with growing-stock trees.

## Stocking

Stocking is a measure of how well the productive potential of the site is utilized by trees. For stands with a mean d.b.h. of at least 8 inches, the measure of stocking used is relative density expressed as a percentage of normal stocking; i.e., the current number of trees per acre expressed as a percentage of the normal number indicated for a stand of the same mean diameter and species. For stands with a mean diameter of less than 8 inches, stocking is not an indication of the current level of site utilization but rather it is an estimation of the degree of site utilization expected when the stand reaches 8 inches in mean diameter. For such stands, the stocking standard is the normal number of trees for an 8-inch stand, discounted for expected mortality. In stands of mixed size and species, the density standard is a weighted average for the various species and sizes of trees present.

In general, stocking standards are based on normal yield tables such as those in USDA Technical Bulletin No. 630 (Meyer 1961). Some sites, however, because of hot dry conditions, serpentine soils, rock outcrops, or other restrictions, are unable to support the density of trees indicated by the normal yield tables. On such areas, stocking standards are adjusted to reflect lower stocking capacity (MacLean and Bolsinger 1973b, 1974).

Full normal stocking (100 percent in this report) requires far more trees than are needed to fully occupy the site. In this study, stands in excess of 60-percent stocking are considered to be fully occupying their sites.

*Stockability* is the capability of forest land to support a specified number of trees of specified species, age, and size. Normal yield tables define stockability levels for sites with no restrictions on the capability of the land to support trees.

## Timber Volume

### *Live Sawtimber*

Net volume of live sawtimber trees of commercial species is measured in board feet. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

*Scribner rule* is the common board-foot log rule used locally in determining volume of sawtimber. Scribner volume was computed on a 16-foot log basis to a utilized top for trees 11.0-inch d.b.h. and larger.

*International 1/4-inch rule* is the standard board-foot log rule adopted nationally by the Forest Service for the presentation of volume statistics. For calculating International 1/4-inch board-foot volume the minimum diameter for softwood trees is 9.0-inch d.b.h., the minimum log length is 12 feet, and the small end diameter is 7.0 inches outside bark. The minimum diameter for hardwoods is 11.0-inch d.b.h., the minimum log length is 8 feet, and the small end diameter is 9.0 inches outside bark.

*Growing Stock*

Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark is measured. Net volume equals gross volume less deduction for rot and missing bole sections.

*Industrial Wood*

All roundwood products, except fuelwood, are included.

*Net Annual Growth*

The net increase in volume of trees during a specified year. Components of net annual growth include: (a) the increment in net volume of trees at the beginning of the specified year surviving to the year's end plus (b) the net volume of trees reaching merchantable size class during the year minus (c) the net volume of trees that died during the year minus (d) the net volume of trees that become culls during the year.

## Ownership Classes

*National Forest lands* are Federal lands which have been designated by Executive Order or statute as National Forests or purchase units and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

*Other public lands* are Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and miscellaneous Federal agencies, and lands owned by States, counties, and local public agencies or lands leased by these governmental units for more than 50 years.

*Forest industry lands* are owned by companies or individuals operating wood-using plants.

*Farmer-owned lands* are lands owned by operators of farms.

*Miscellaneous private-corporate lands* are owned by companies or corporations that do not operate wood-using plants. Included are corporate farms, some railroad lands, oil company lands, real estate and land-holding company lands, and lands held by banks and other financial institutions and various other companies and corporations.

*Miscellaneous private-noncorporate lands* are privately owned lands other than forest industry, farmer-owned, or corporate lands.

# PLANT SPECIES

*Scientific and Common Names of Plants Mentioned in This Report*[2]

| | |
|---|---|
| *Abies concolor* (Gord. & Glend.) Lindl. | white fir |
| *Abies magnifica* A. Murr. | California red fir |
| *Acer macrophyllum* Pursh | bigleaf maple |
| *Adenostoma fasciculatum* H. & A. | chamise |
| *Aesculus californica* (Spach) Nutt. | California buckeye |
| *Alnus rhombifolia* Nutt. | white alder |
| *Arbutus menziesii* Pursh | Pacific madrone |
| *Arctostaphylos* spp. | manzanita |
| *Artemisia* spp. | sagebrush |
| *Atriplex* spp. | saltbush |
| *Ceanothus* spp. | ceanothus |
| *Cercis occidentalis* Torr. | California redbud |
| *Cercocarpos* spp. | mountainmahogany |
| *Chrysothamnus* spp. | rabbit-brush |
| *Juniperus occidentalis* Hook. | western juniper |
| *Juniperus osteosperma* (Torr.) Little | Utah juniper |
| *Larrea divaricata* Cav. | creosote bush |
| *Libocedrus decurrens* Torr. | incense-cedar |
| *Photinia arbutifolia* Lindl. | toyon |
| *Pinus contorta* Dougl. | lodgepole pine |
| *Pinus jeffreyi* Grev. & Balf. | Jeffrey pine |
| *Pinus lambertiana* Dougl. | sugar pine |
| *Pinus monophylla* Torr. & Frém. | singleleaf pinyon |
| *Pinus monticola* Dougl. | western white pine |
| *Pinus ponderosa* Laws. | ponderosa pine |
| *Pinus sabiniana* Dougl. | Digger pine |
| *Populus fremontii* S. Wats. | Fremont cottonwood |
| *Populus tremuloides* Michx. | quaking aspen |
| *Populus trichocarpa* Torr. & Gray | black cottonwood |
| *Pseudotsuga menziesii* (Mirb.) Franco | Douglas-fir |
| *Purshia tridentata* (Pursh) DC. | bitterbrush |
| *Quercus chrysolepis* Liebm. | canyon live oak |
| *Quercus douglasii* Hook. & Arn. | blue oak |
| *Quercus garryana* Dougl. var. *semota* Jeps. | scrub oak; shin oak |
| *Quercus kelloggii* Newb. | California black oak |
| *Quercus lobata* Née | California white oak |
| *Quercus wislizenii* A. DC. | interior live oak |
| *Sarcobatus vermiculatus* (Hook.) Torr. | greasewood |
| *Sequoiadendron giganteum* (Lindl.) Buchholz | giant sequoia |
| *Tsuga mertensiana* (Bong.) Carr. | mountain hemlock |
| *Umbellularia californica* (Hook. & Arn.) Nutt. | California-laurel |

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[2] The source for most tree names is Little (1953); for other plants the source is Munz and Keck (1970). Griffin and Critchfield (1972) are authorities on tree distribution within California.

## *Scientific and Common Names of Mammals and Birds Mentioned in This Report*

### Mammals

| | |
|---|---|
| *Odocoileus hemionus* (Say) | mule deer |
| *Urocyon cinereoargenteus townsendi* Merriam | grey fox |
| *Lepus* spp. Gray | rabbit |
| *Sylvilagus* (Bachman) | rabbit |

### Birds

| | |
|---|---|
| *Alectoris graeca* | chukar |
| *Lophortyx* spp. | quail |
| *Oreortyx* spp. | quail |
| *Columba fasciata* | band-tailed pigeon |

Bolsinger, Charles L.
1978. Forest area and timber resources of the San Joaquin resource area, California. USDA For. Serv. Resour. Bull. PNW-75, 71 p., illus. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

This report presents statistics on forest area and timber volume and a description of the recent and future timber situations in Alpine, Amador, Calaveras, Fresno, Kern, Kings, Madera, Mariposa, Merced, Mono, San Joaquin, Stanislaus, Tulare, and Tuolumne Counties, California.

KEYWORDS: Forest surveys, statistics (forest), timber resources, resources (forest), California (central).

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2. Developing and evaluating alternative methods and levels of resource management.
3. Achieving optimum sustained resource productivity consistent with maintaining a high quality forest environment.

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*Mailing address: Pacific Northwest Forest and Range*
*Experiment Station*
*P.O. Box 3141*
*Portland, Oregon 97208*